JUL 14 1959

# CANADIAN ELECTRONICS ENGINEERING

JULY 1959
A Maclean-Hunter Publication
five dollars a year

Anodized insulation permits close design tolerances .... 20

Recent events show electronics progress ..... 22

New bridge ends two bottlenecks ..... 25

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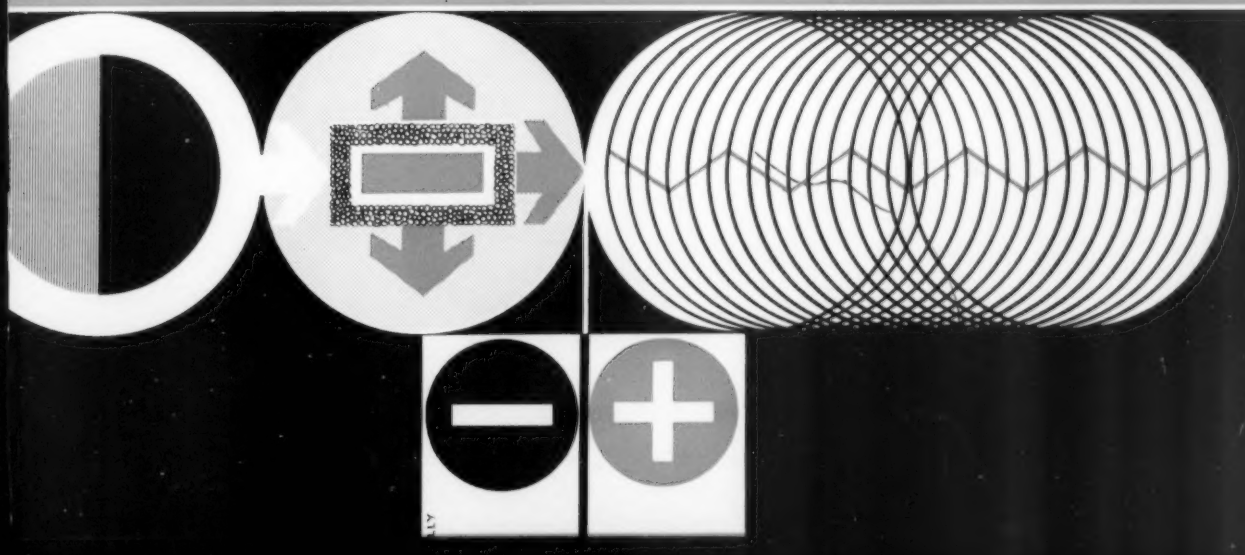

# BOMAC BEACON MAGNETRONS

Pioneer space probe shown being launched by a Jupiter C missile. Bomac beacon magnetrons are an integral part of these programs.

**MINIATURIZED · WITHSTAND HIGH SHOCK · LIGHTWEIGHT**

For the highest possible reliability under the most severe environmental conditions, Bomac's complete line of beacon magnetrons have proved they can take it. They have successfully withstood accelerations of 20,000 g's, have survived centrifuge tests where the applied acceleration was in the order of 20,000 g's, and have operated satisfactorily when subjected to vibrations at a 30-g level from 50 to 2000 cps.

| Tube | Ef Volts | If Amps | Peak Anode Voltage | Peak Anode Current Amps | Peak Power Watts | Frequency Mcs | Output Mates To | Weight | Bac |
|---|---|---|---|---|---|---|---|---|---|
| BL-212 | 5.0 | 0.5 | 1200 V | 0.8 | 100 | 5400–5900 | 50Ω SM Jack | 8 oz. | |
| BL-223 | 5.0 | 0.7 | 1900 V | 1.1 | 400 | 5400–5900 | 50Ω TNC Plug | 10 oz. | |
| BL-226 | 5.0 | 0.5 | 1300 V | 0.9 | 100 | 9100–9500 | 50Ω TNC Plug | 8 oz. | |
| BL-227 | 5.0 | 0.5 | 1300 V | 0.9 | 100 | 8700–9100 | 50Ω TNC Plug | 8 oz. | |
| BL-228 | 5.0 | 0.5 | 1300 V | 0.9 | 100 | 8300–8700 | 50Ω TNC Plug | 8 oz. | |
| BL-230 | 5.0 | 0.7 | 2800 V | 1.9 | 1000 | 5400–5900 | 50Ω TNC Plug | 10 oz. | |
| BL-231 | 5.0 | 0.5 | 1450 V | 1.0 | 200 | 5400–5900 | 50Ω SM Jack | 8 oz. | |
| BL-233 | 5.0 | 0.7 | 2800 V | 1.5 | 1000 | 9375 | UG 40/U | 11 oz. | |
| BL-242 | 5.0 | 0.7 | 1900 V | 1.1 | 400 | 5400–5900 | TNC or 50Ω N Plug | 10 oz. | |
| BL-243 | 5.0 | 0.5 | 1450 V | 1.0 | 200 | 5400–5900 | 50Ω SM Jack | 8 oz. | |
| BL-245 | 5.0 | 0.7 | 2800 V | 1.9 | 900 | 5400–5900 | 50Ω TNC Plug | 10 oz. | |
| BL-247 | 5.0 | 0.5 | 1200 V | 0.8 | 100 | 9100–9500 | 50Ω TNC Plug | 8 oz. | |
| BL-250 | 5.0 | 0.5 | 1350 V | 1.0 | 150 | 5400–5900 | 50Ω TNC Plug | 8 oz. | |
| BL-M003 | 5.0 | 0.5 | 1300 V | 0.9 | 100 | 9100–9500 | 50Ω TNC Plug | 7 oz. | |
| BL-M004 | 5.0 | 0.5 | 1200 V | 0.9 | 150 | 8900–9100 | 50Ω TNC Plug | 8 oz. | |
| BL-M007 | 5.0 | 0.5 | 1300 V | 0.9 | 100 | 9100–9500 | 50Ω TNC Plug | 8 oz. | |
| BL-M008 | 5.0 | 0.7 | 2200 V | 1.1 | 400 | 5400–5900 | 50Ω TNC Plug | 10 oz. | |

Leaders in the design, development and manufacture of TR, ATR, Pre-TR tubes; shutters; reference cavities; crystal protectors; silicon diodes; magnetrons; klystrons; duplexers; pressurizing windows; noise source tubes; high frequency triode oscillators; surge protectors.

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July 1959

Volume three, number 7

# CANADIAN ELECTRONICS ENGINEERING

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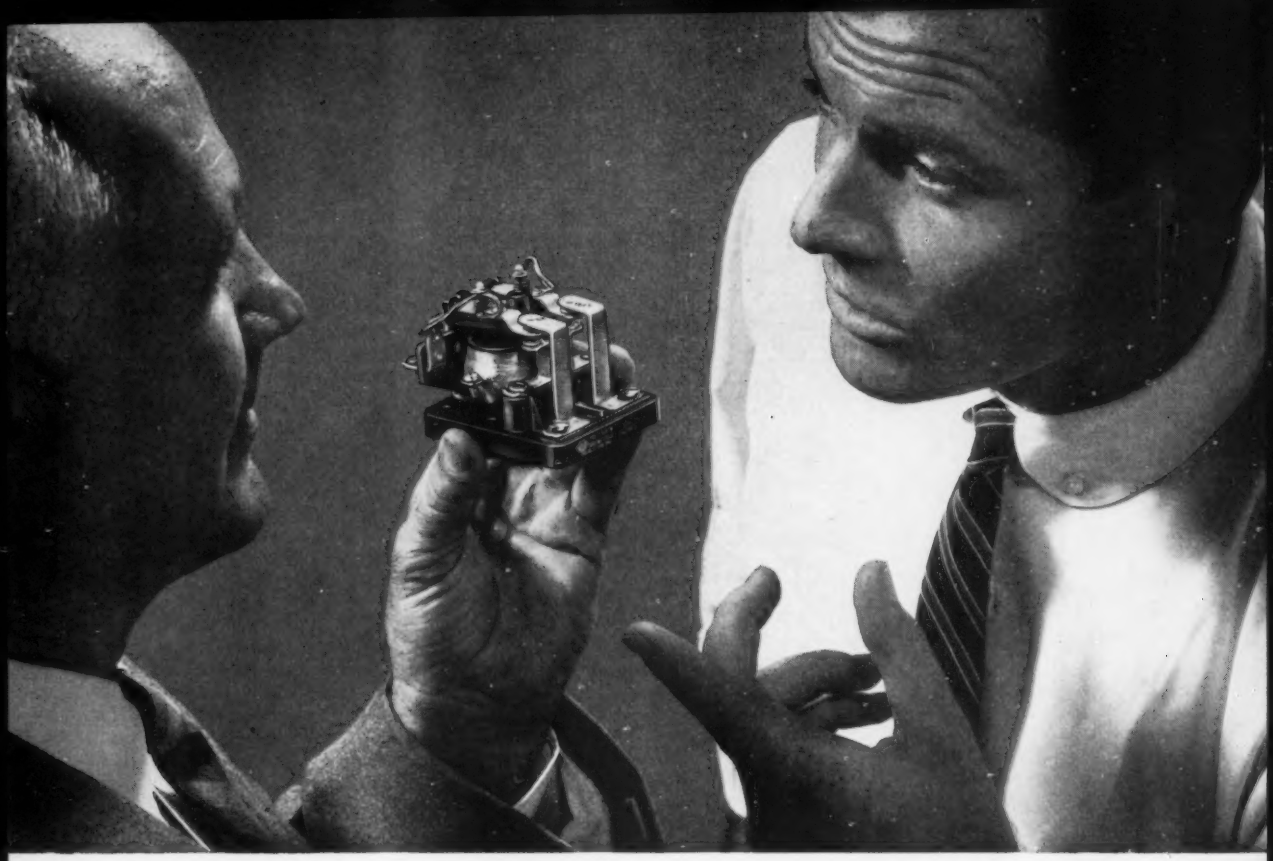
***our cover design**

*Cover artist G. N. Reilly has captured a comprehensive story of wire going through an anodizing bath and ending up in a traveling wave tube focusing solenoid.*



HERE'S WHY P&B's PR POWER RELAY IS PREFERRED

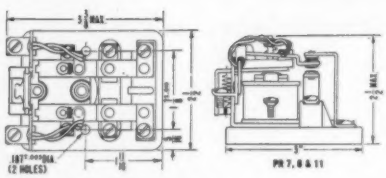
# for high current/voltage switching

**HEAVY DUTY** construction means long-term dependability when switching up to 20 amperes (double break contacts). Here is a ruggedly built relay, packed with high quality features, yet economically priced.

The PR's full floating movable contact carrier, for example, provides excellent contact pressure and ample wipe for self-cleaning contact action. The coil is centrifugally impregnated with top-grade varnish to eliminate moisture traps.

Contact arrangements up to DPDT are available. The PR has been adapted for printed circuitry and heavy duty plug-in applications.

All standard AC actuated PR relays may carry the UL and Canadian Standards Association seals of approval. Write or call for complete information.



**GENERAL SPECIFICATIONS:**
**Breakdown Voltage:** 1500 volts rms min. between all elements and ground.
**Ambient Temperature:** DC: —55° to +85°C.
AC: —55° to +55°C.
**Terminals:** Heavy duty screw type. Standard printed circuit pins or plug-in on request.
**Enclosures:** PR dust cover.

**CONTACTS:**
**Arrangements:** Up to 2 Form C (DPDT).
**Material:** 5/16" dia. silver or silver cadmium oxide. (Others available)
**Load:** Single break: 15 amps; Double break: 20 amps at 115 volts 60 cycle AC resistive.

**AUXILIARY CONTACTS:**
**Arrangements:** 1 Form A, B or C.
**Material:** 3/16" diameter silver
**Rating:** 5 amps at 115 volts 60 cycle AC resistive.

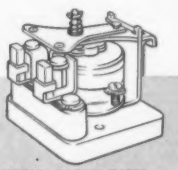
**COILS:**
**Resistance:** 64,000 ohms maximum.
**Power:** 1.8 watts DC; 9.8 volt-amps AC.
**Duty:** Continuous AC or DC (DC coils will withstand 10 watts at 25°C).
**Insulation:** Centrifugally impregnated with high quality varnish.
**Mountings:** 2 holes .187" diameter 1⅞" o.c.

**PR Relays Approved By Underwriters' Laboratories and Canadian Standards Association**

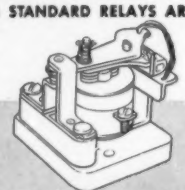
| Type | Contact Arrangement* | Type | Contact Arrangement* |
|---|---|---|---|
| PR1AY | SPST-NO | PR5AY | SPDT |
| PR2AY | SPST-NC | PR7AY | DPST-NO |
| PR3AY | SPDT-NO-DM | PR8AY | DPST-NC |
| PR4AY | SPDT-NC-DB | PR11AY | DPDT |

These relays are available in any of the following operating voltages: 6, 12, 24, 48, 115, 208, 230, or 440 volts 50/60 cycles AC.
The contacts are rated at: 13 amps, 115 volts AC. 6.5 amps, 230 volts AC. 1 hp for 115 or 230 volt AC motors.
Any relays deviating electrically or physically from these standard models will not carry U/L or CSA approval.
*Read: NO normally open, NC normally closed, DB double break, DM double make.

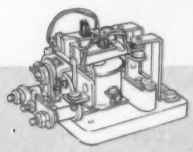
**P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR**



**PR RELAY WITH MAGNETIC BLOW-OUTS**
Models PR3 and PR7 can be supplied with alnico magnets to suppress arcs on DC loads over 1200 watts.



**SINGLE POLE DOUBLE THROW VERSION**
PR 5 (SPDT) has all the heavy-duty features of other models in this series.



**PR WITH AUXILIARY CONTACTS**
All PR models can be equipped with auxilliary contacts in 1 Form A, B, or C arrangements.

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Guelph, Ontario

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## contributors and special articles in this issue:

Last November we published the first contribution to CEE by **G. R. Pink** of the Aluminum Company of Canada. In it he described the successful development of anodized aluminum wire and some of its useful properties. This month, in his article "Anodized insulation permits close tolerances in design work," he follows up with an account of one of the first applications of this type of wire.

Mr. Pink is a native of Winnipeg and an electrical engineering graduate from the University of Manitoba. Starting as a sales engineer in Alcan's Toronto office, he has been with the company for eight years, currently holding the position of electrical conductor development engineer.

Our survey of recent meetings and conferences (Recent events show electronics progress) was written by editorial assistant **Roy Grant.** Roy obtained his BA at St. Mary's University, Halifax, in 1954, then taught school in his home town, Summerside, P.E.I., before coming to Toronto. He is now an editorial assistant on several Maclean-Hunter business publications, but is no stranger to matters affecting the Canadian electronics industry: he spent the last three years as an associate editor with Canadian General Electric's employee newspaper.

The story of how Bell Telephone's cables are carried across the Burlington Beach Skyway (New bridge ends two bottlenecks) was sent to us by an old friend, **Dennis Pelrine,** former associate editor of Civic Administration. He is now doing public relations work for Canadian Johns-Manville Co. Ltd. with the MacLaren Advertising Co.

**K. A. Steele** (Broadband harmonic generator converts from S-band to X-band) is another University of Manitoba graduate making his second appearance in CEE. He was co-author with A. Staniforth in May, 1958, of an article about casting lossy microwave parts in resin.

Mr. Steele has been with the Radio and Electrical Engineering Division of the National Research Council, Ottawa, since his graduation in 1953. He is a member of the Institute of Radio Engineers.

Associate editor **Ian R. Dutton** wrote the story about the completion of the microwave system across Newfoundland and linking the province to the mainland. Ian missed attending the EIA of Canada annual meeting this year. Mrs. Dutton provided compensation by presenting him with a son. U. of T. class of 1981?

NAKASH

**Pink**

**Steele**

# HIGH FIDELITY MEASUREMENTS

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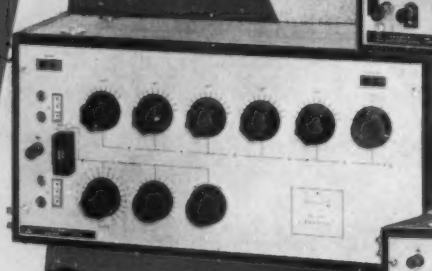

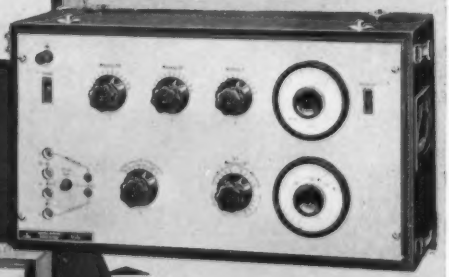

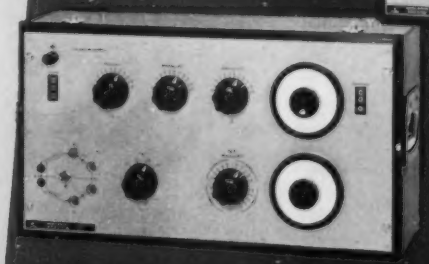

Inductance Bridge
0.1 μh/1,000 h ..... Rel 3 R
Frequency Range ..... 200 cps to 5 Kcs
Measuring Error for DC Resistance ..... ± 2%

Constancy Bridge for Inductors and Capacitors ..... 3 R 119
Frequency Range ..... 8 to 100 kc
Impedance limits for the specimen ..... approx. 50 to 5,000Ω
Measuring Error ..... 7 x 10⁻⁵

Capacitance Bridge
0.001 μμ F/100μF ..... 3 R 116
Frequency Range ..... 200 to 10,000 cps
Measuring Error ..... ± 0.1%

Capacitance Bridge
0.0001/1,000 μμF ..... 3 R 127
Frequency Range ..... 0.1 to 1 Mc
Measuring Error in main range ..... 0.2%

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The high fidelity of Siemens Measuring Bridges provides the utmost in reliability, accuracy, stable calibration and speedy, simple operation. These profit-producing qualities combined with rugged construction make Siemens equipment the wisest choice for all electronic, electrical and communications measurements.

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# News highlights . . .

## $5,000,000 to help get defense orders . . .

The federal government has set aside $5 million to help Canadian electronics firms qualify for U.S. defense contracts. The funds will be used to subsidize development projects and provide assistance during early production stages. A further $450,000—in addition to $500,000 in the main defense production estimates—will help establish production facilities for items previously imported.

## Radio sales soar, television down slightly . . .

Latest figures from EIA show distributor sales to dealers of radio receivers in the first four months of 1959 up 26% compared with 1958. Sales to the end of April were 176,083 units (1958—139,251 units). Television receiver sales were down about 5% at 116,786 units, compared with 121,871 at the end of April, 1958.

## Assign Avro scientists to U. S. space plan . . .

Twenty-five former Avro Aircraft scientists and engineers have been assigned by the National Aeronautics and Space Administration, Washington, to its Project Mercury, a program to develop a manned space capsule. The services of the group, which is headed by former Avro chief designer James A. Chamberlain, were offered by the Canadian firm as an "extended leave of absence."

## Titania to study ceramics requirements . . .

Titania Electric Corporation of Canada Ltd., Gananoque, Ont., has been awarded a ceramic engineering research contract by the Canadian government to study the future requirements of Canada for ceramics in electronic applications. Current applications are in missile and ultrasonic transducers, and in nuclear instrumentation.

## Newfoundland microwave link completed . . .

Canadian television viewers were able to watch Queen Elizabeth and Prince Philip when they landed in Newfoundland June 18, after completion of the $9 million microwave system across the province and linking it to the mainland. Canadian National Telegraphs personnel worked overtime to finish installation and testing. Story and pictures of the link appear in this issue.

## Death rays included in anti-missile research . . .

Washington's defense department has contracted a dozen firms to develop "any unorthodox" anti-missile methods, including death rays and anti-gravity machines, under phase 1 of a new program called GLIPAR—Guide Line Identification Program for Anti-Missile Research. Most promising missile defense proposals will be pursued under phase 2 of the GLIPAR program.

## BBG radio regulations effective June 1 . . .

The Board of Broadcast Governors have introduced a set of regulations for sound radio broadcasting stations, effective June 1, 1959. The new regulations are a substitute for those formerly made by the Board of Governors of the CBC, and will also apply to television until the BBG issues separate regulations governing TV.

## Electronics market knows no boundaries . . .

The world-wide nature of the electronics market was emphasized by recent announcements. While Canada bemoaned the influx of Japanese components and transistor radios, Muirhead & Co. Ltd., British instrument manufacturers, installed $230,000 worth of facsimile equipment in Japan. It is used in production of the newspaper Asahi Shimbun at Sapporo, 500 miles from the paper's head office in Tokyo. At the same time, International Business Machines air-freighted a RAMAC computer from their Don Mills, Ont. plant to Aufina at Zurich, Switzerland.

# Simpson WIDE BAND LABORATORY OSCILLOSCOPE

## Model 2610

1958
I. R. E. AWARD

The wide and immediate acceptance of the Model 2610 has provided ample justification for the original techniques adopted in the design of this instrument. Versatility and convenience, allied with precision performance, make this an ideal oscilloscope for general laboratory use.

The vertical deflection system has a sensitivity in excess of 3.3 millivolts r.m.s./cm. and offers a choice of A.C. or D.C. coupling with either a linear response to 6 Mc/s or a suitable roll-off for transient observations; in the latter condition the rise-time is 80 millimicroseconds with overshoot less than 3%. For pulse observation a 0.3 microsecond signal delay can be switched in. Marker signals can be applied via a differential input terminal.

Associated with the vertical deflection system is a unique and permanent internal calibration circuit which, in conjunction with the built-in meter, permits the measurement of waveform amplitudes to an accuracy of 3%.

The horizontal deflection system offers recurrent sweeps from 3 c/s to 500 Kc/s and precalibrated triggered sweeps of 5, 50, 500 and 5,000 microseconds duration; triggering and blanking can be either internal or external or an external time base signal can be applied.

A flat-faced 5" C.R.T. is used and provision is made for camera mounting.

Conservative operation of components, combined with ingenious design, makes it possible to provide this high standard of performance with reliability, and at a remarkably modest cost.

Price, including signal cables, line cord, graticule and filter — $550.00, f.o.b. London, Sales Tax Extra.

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# Canadian General Electric appoints three vice-presidents

**Robert M. Jennings, W. Frank Wansbrough** and **Walter G. Ward** have been appointed vice-presidents of Canadian General Electric Co. Ltd.

Mr. Jennings is general manager of the small appliance department at Barrie, Ont. Mr. Wansbrough, with offices in the company's major appliance headquarters, Montreal, is general manager of the appliance and television receiver department. Mr. Ward is general manager of the apparatus department at Peterborough.

New sales manager of distribution and instrument transformers in the company's industrial products department is **Robert M. Love.** Mr. Love had been manager, Ontario district sales, for IPD since 1954.

Also announced was the appointment of **Charles J. Snelson** to occupy the Ontario district sales managership vacated by Mr. Love. Since 1952, Mr. Snelson was sales manager of component heating devices.

BELL

**Jennings**

ARMAND

**Wansbrough**

NOTT

**Ward**

**Cowan**

### Daystrom appoints vice-president

Daystrom Ltd., Toronto, has appointed **H. W. Cowan** as vice-president and general manager. Mr. Cowan has been manager of the firm since its establishment in 1957.

### Vice-president and general manager

Stuart D. Brownlee, president, Ensign Acceptance Corp. announces the appointment of **Edward J. Mullen** as vice-president and general manager of Ensign, a wholly owned subsidiary of Canadian Admiral Corp. Ltd. Mr. Mullen has been general manager of Ensign since February 1958; he was formerly internal auditor for Canadian Admiral.

### Electronics sales representative

Pylon Electronic Development Co. Ltd. has acquired the services of **Roger Desrosiers** as technical sales representative. Mr. Desrosiers formerly was associated with Stromberg-Carlson.

**Desrosiers**

**Noble**

### R. C. Kahnert Sales Ltd. reports appointments

In line with expansion plans in the industrial and communications field, R. C. Kahnert, president, R. C. Kahnert Sales Ltd., Scarborough, announces the appointment of **Aurele Desjardins** as vice-president and director. He will be responsible for sales in Quebec province and the Ottawa area. **Jim Noble,** formerly sales manager of Antiference Canada Ltd. is now Kahnert sales director.

### President of Radio Valve retires

After 38 years in the Canadian electronics industry, **Walter Earl "Davey" Davidson,** president of Radio Valve Co. Ltd., has retired.

Born in Maysfield, N.Y. in 1893, Mr. Davidson came to Canada in 1921 to head a development - production laboratory which became the Vacuum Tube Division of Canadian General Electric Co. Ltd. and his career since then has parallelled the development of radio in Canada. Radio's increasing popularity necessitated numerous expansions in tube-making facilities. In 1932 Mr. Davidson was appointed managing director of Radio Valve Co. In 1940 he organized and directed a tube-making plant for Research Enterprises Ltd. capable of manufacturing 500 radar tubes daily for allied forces.

In 1946 Mr. Davidson commenced production of loudspeakers in the firm's plant. Two years later he was appointed president of the company. Since that time, operations have been expanded to include manufacture of picture tubes, germanium diodes and transistors.

A testimonial dinner in honor of Mr. Davidson was held in Toronto in May.

### Northern Electric appointments

Three executive appointments have been announced by Northern Electric Co. Ltd. **F. G. Samis** is new marketing manager of the firm's sales division, succeeding H. C. Way. Mr. Samis rose from priorities supervisor to assistant comptroller of purchasing. A year later, in 1948, he became comptroller of purchasing, holding that position until 1953 when he was appointed commercial manager.

**H. C. Way** becomes manager of the central zone of Northern Electric's sales division. In 1952 he moved to Vancouver as district sales manager, becoming assistant district manager in 1955 and manager of the Pacific district the same year. Since 1958 he has been marketing manager of the sales division, with headquarters in Montreal.

New commercial manager is **Frederic J. Fortier.** In 1953 Mr. Fortier was assistant sales manager of the company's eastern district, becoming assistant manager of organization planning in 1954, sales manager of the eastern district in 1956 and assistant zone manager in 1957.

**Samis**

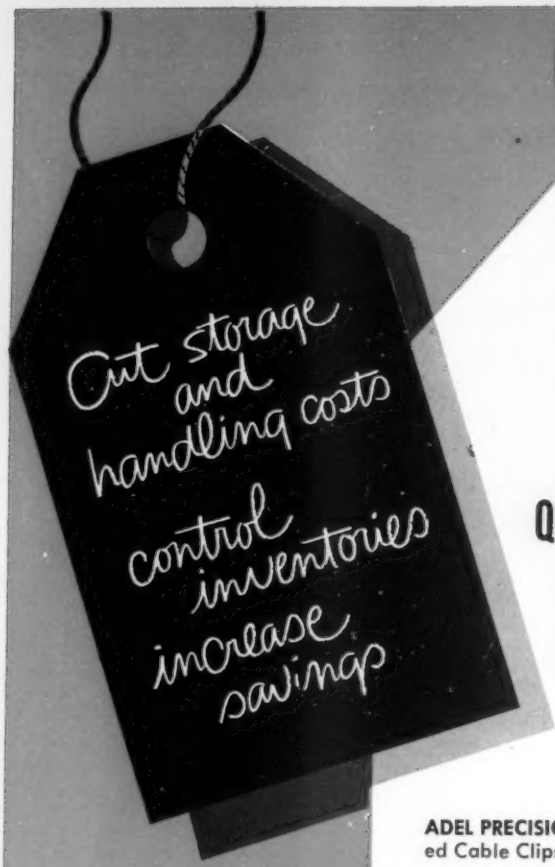
COMM. ILLUS.

**Way**

### Patents promotion officer

Canadian Patents and Development Ltd. has appointed **K. G. Lund, P.Eng.,** as patent promotion officer dealing with patents in the electrical and electronic fields. Mr. Lund, born in Harrow, England, graduated from the University of Manchester (Honor Physics) in 1954. He joined the RCAF in England and served in Canada as a flying officer in the telecommunications branch. In 1958 he entered the University of Western Ontario to take a graduate course in business administration. Upon completion of the course he joined Canadian Patents and Development Ltd.

**(Continued on page 42)**

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# Dominion Sound, General Theatre Supply form new sales company

General Theatre Supply Company Limited and Dominion Sound Equipments Limited have concluded an agreement under the terms of which the theatre and sound system departments of the respective companies will operate, in the future, under the name of General Sound and Theatre Equipment Ltd.

Lloyd C. Pearson, who has been general sales manager of Dominion Sound Equipments Limited, has been named president and general manager of the new organization. Andrew G. Rouse will be executive vice-president. A. D. Turnbull, chief engineer and manager of theatre sales and service department for Dominion Sound will undertake the same duties in General Sound and Theatre Equipment Limited.

**Pearson**

The new company will operate under a franchise from Northern Electric Co. Ltd. to distribute in Canada the same sound system products which were being distributed by Dominion Sound Equipments Ltd.

**New principal for Ahearn and Soper**

The Ahearn and Soper Co. Ltd., Ottawa, has added National Union Electric Corp., Bloomington, Ill., to its list of principals. The Canadian firm now complements its line of tubes with high-voltage regulators, digital read-out and magnetic pick-up tubes.

**Canadian Marconi cuts deficit, ups capital**

Canadian Marconi slashed the $1.5 million deficit it inherited from 1957 to $386,844, making 1958 a year for new gains and improvements. Working capital also improved, standing at $4,147,479 compared to $3,832,298 the year before. In addition, some $579,000 of development expenditure deferred, which showed in 1957 bookkeeping, has been absorbed in the operation.

**Canadian firms announce merger**

Canadian Applied Research Ltd. and Phoenix Engineering Products Ltd. have been merged by A. V. Roe Canada Ltd. into one corporation that will continue under the name of Canadian Applied Research Ltd.

The Phoenix operations will now be carried out by CARL's repair and overhaul division. CARL's manufacturing, sales and service, and finance divisions, together with the administrative offices, have moved from 1,500 O'Connor Drive to 750 Lawrence Ave. W., Toronto. Engineering division will remain at the former address.

**Westinghouse drops 1958 sales, earnings**

Sharply reduced shipments of defence equipment and railroad air brakes figured strongly in the seven percent sales drop Canadian Westinghouse experienced in 1958. The company's 55th annual report set '58 sales at $139,408,471. Earnings consequently showed a 17 percent decrease at $2,605,484, with earnings per share amounting to $4.26 as compared with $5.16 in 1957.

**Representative for Leetronics**

William B. Hummel, Port Credit, Ont., has been appointed sales representative in Ontario and Quebec for Leetronics, Inc. Products consist of special design rotary solenoids for micro - waveguide switching, fail - safe flag signals for position indicators, and solenoids for industrial use.

**Former Avro men start own company**

Six former A. V. Roe employees have pooled their money to establish a manufacturing company in Port Hope, Ontario, that will handle light engineering, sheet metalwork and electronics. On last report, they were looking for suitable premises.

The company, to be known as Glosta, takes its name from the first letters of the six leaders. Their combined experience will enable them to design and produce for customers: drawings of mechanical parts, electronics, chassis, switchboards and mechanical fabrication and assembly.

**U. S. company starts manufacturing in Toronto**

Fanon Electronics of Canada Ltd. has started manufacturing at 431 King St. West, Toronto. Product lines include internal telephone systems, intercom systems, PAX units and equipment for apartment house door answering, and a range of phonographs under the brand name of Fanfare.

In charge of the Canadian operation is H. Rosen, treasurer. Active Radio & TV Ltd., Toronto will remain as sales agents for Fanon.

**APEO certification adopted by U. S.**

The U. S. plans to adopt the certification program for engineering technicians and technologists originated by the Association of Professional Engineers of Ontario.

The National Society of Professional Engineers in Washington, D.C., has recommended that all state societies adopt the Ontario program. It would be revised only to fit U. S. educational standards. The Wisconsin society has already adopted it.

The APEO plan grades technicians and technologists into four categories according to training and experience on the belief that this would encourage them to progress to top efficiency. It also serves to define the upgrading of technical employees.

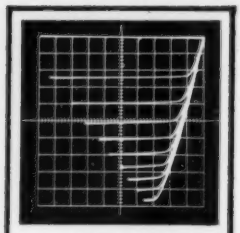
There are now 900 to 1,000 certified engineering technicians and technologists in Ontario with certification being carried out at the rate of 75 new members per month.

**(Continued on page 43)**

*Members of the APEO engineering technicians and technologists advisory committee are, l-r: N. H. Kargas, Dr. G. B. Langford (rear) co-chairman, F. A. Beeby co-chairman, H. Lansing, A. Jacobs, E. W. Gordius, C. A. MacMillan.*

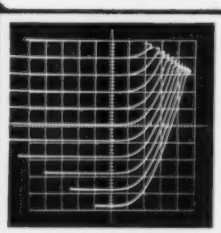
*Displays 4 to 12 curves per family with input current from*

**1 MICROAMP/STEP to 200 MILLIAMPS/STEP**



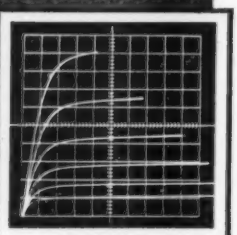
*HIGH COLLECTOR CURRENT*

*PNP transistor, collector current vs collector voltage with constant-current base steps. Collector sweep is 0 to 5 v with a 0.25-ohm load, base current is 50 ma/step. Vertical deflection is 1000 ma/div, horizontal 0.5 v/div.*



*HIGH INPUT CURRENT*

*PNP transistor, collector current vs collector voltage with base grounded and constant-current emitter steps. Collector sweep is 0 to 1.5 v, emitter current 200 ma/step. Vertical deflection is 200 ma/div, horizontal 0.1 v/div. Zero voltage is at center scale.*



*LOW INPUT CURRENT*

*NPN transistor, collector current vs collector voltage with constant-current base steps. Collector sweep is 0 to 1.5 v, base current 1 microamp/step. Vertical deflection is 10 microamp/div, horizontal 0.1 v/div.*

# Transistor-Curve Tracer

**TYPE 575 CHARACTERISTICS**

**Positive or Negative Collector Sweep**

Collector supply—0 to 20 v, 10 amperes average current.
—0 to 200 v, 1 ampere average current.

Dissipation limiting resistors—0 to 100-kilohms in 17 steps.

**Positive or Negative Base Stepping**

4 to 12 steps per family, repetitive or single family display.

17 current-per-step positions, 1 μa/step to 200 ma/step.

5 voltage-per-step positions, 0.01 v/step to 0.2 v/step, with 24 series resistance values from 1 ohm to 22 kilohms.

**Calibrated Display**

Vertical axis—

Collector current, 16 steps from 0.01 ma/div to 1000 ma/div.

Pushbuttons are provided for multiplying each current step by 2 and dividing by 10, increasing the current range to 0.001 to 2000 ma/div.

Horizontal axis—

Collector volts, 11 steps from 0.01 v/div to 20 v/div.

Both axes—

Base volts, 6 steps from 0.01 v/div to 0.5 v/div.

Base current, 17 steps from 0.001 ma/div to 200 ma/div.

Base source volts, 5 steps from 0.01 v/div to 0.2 v/div.

**Test Condition Selector**

Select either common-emitter or common-base configuration.

**Price $975 f.o.b. factory**

## 20-Ampere Collector Displays

(10-ampere average supply current)

## 2.4-Ampere Base Supply

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**A feature in . . .**
**FEDERAL TYPE B RURAL DISTRIBUTION WIRE**

Because of its high tensile strength, it is ideal where longer spans are required. Its rugged construction gives excellent service life and permits re-use after emergency operation. Thus, considerable time and expense are saved in new construction. Engineered for maximum dielectric strength, low transmission loss and cross talk, Federal Rural Distribution Wire provides the best in subscriber service at minimum cost.

**Another fine product . . .**
**FEDERAL TYPE NC TELEPHONE DROP WIRE**

is specially built for life-long resistance to severe wind and ice-loading conditions. Its high dielectric rubber insulation is securely bonded to No. 18 copperweld conductors. The tough, reinforced neoprene sheath is ribbed for quick polarity identification by touch. It comes in solidly taped 1,000 foot "Tangle-proof" coils for fast, efficient installation. Buy Federal quality for dependable service.

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# VIBRATION RESISTANT
# MOISTURE RESISTANT

***Completely interchangeable***

*New miniature connectors for avionic equipment meet MIL-C-26482 (ASG)*

Actual size photo shows three pin bayonet coupling type. Double stub type available. Both types completely interchangeable with other miniature connectors.

# BANTAM

ENVIRONMENTALLY-SEALED ELECTRICAL CONNECTORS

Electrically, mechanically, BANTAM connectors are designed for dependable performance despite environmental extremes. Copper alloy closed entry contacts, heavily gold-plated... moisture-proof resilient inserts... cadmium-plated shells of high-tensile strength aluminum... heavy spring tension for perfect interface sealing. Also available are potting boot and cable clamp types.

H. H. BUGGIE
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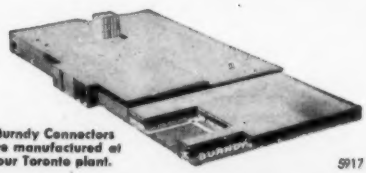

Burndy Connectors are manufactured at our Toronto plant.

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# TO SERVE YOU BETTER CGE NOW MANUFACTURES A WIDE RANGE OF GERMANIUM AND SILICON DIODES

**IN34, IN34A, IN35, IN38, IN38A, IN38B, IN48, IN51, IN52, IN54, IN54A, IN636 IN58A, IN63, IN64, IN65, IN67, IN67A, IN68A, IN69, IN69A, IN70, IN70A, IN75, IN81 IN81A, IN90, IN116, I IN126, IN126A, IN IN127, IN127A IN128, IN1 IN198, IN58 I**

For your industrial and military electronic equipment, Canadian General Electric has expanded its semiconductor manufacturing facility to include a comprehensive range of sub-miniature, germanium and silicon crystal diodes. All are of the glass-envelope, hermetically-sealed type. Canadian manufacture automatically brings a reduction in price and a speed-up in delivery time. Also, first-hand manufacturing experience makes C-G-E engineers better equipped to help with your design application problems.

The glass-to-Dumet seals of G-E Crystal Diodes assure uniform, permanent contact between whisker and crystal under severe extremes of temperature, shock and vibration. This "locked-in" electromechanical stability coupled with sub-miniature size can make your electronic equipment smaller and much more rugged.

For complete details on types and new lower prices on J.C.N.A.A.F. approved G-E Crystal Diodes, contact: Electronic Tube Section, Canadian General Electric Co. Ltd., 189 Dufferin St., Toronto, Ontario.

GENERAL ELECTRIC
**SEMI-CONDUCTORS**

*Electronic Tube Section*

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

1684-259

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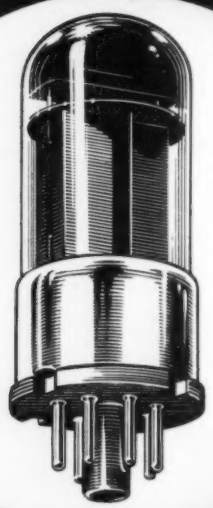
**The Mullard EN33 Thyratron** is an improved plug-in replacement for the 2050 thyratron. One of a line of Rogers Special Quality* tubes, the EN33 has greater electrical ratings than the 2050 and consequently, when operated under similar conditions, offers a longer-life performance. It is smaller in size and has a higher permissible average and peak cathode current. The EN33 has many applications in industrial control circuits, motor and lighting controls, and AC and DC switching.

**Rogers Special Quality tubes are finding more and more applications in all types of professional equipment. The greater reliability and lower maintenance cost of the apparatus in which they are used more than compensates for the higher initial cost.*



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# Grand Scale

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**CORMAG® ACCURACY AND SHIELDING**

*Plus* **prices that'll surprise you**

**WESTON'S NEW, MAGNETICALLY-SHIELDED MODELS 1371 AND 1375 FEATURE 7.2-INCH SCALES**

Here's a new series of panel instruments offering Weston's traditional craftsmanship with a bonus in readability . . . and at low cost, too! Look at these features:

**CORMAG MECHANISM:** means you can mount these rectangulars on magnetic or non-magnetic panels . . . in close proximity to other instruments . . . without special adjustments. They're immune to the effects of stray magnetic fields.

**EXCEPTIONAL READABILITY:** all-plastic fronts, with clear top and sides, provide excellent natural illumination of the oversize scales—without annoying shadows. Normally supplied with lance pointers, for distance reading, these instruments can be supplied with large pointer tips and heavy scale markings as illustrated . . . or with mirror scales and knife-edge pointers for more precise readings.

**HIGH ACCURACIES:** available in most d-c ranges with accuracies from ½% to 2% . . . a-c rectifier types, 3%.

For more details, write to Daystrom Limited, 840 Caledonia Road, Toronto, Ontario; 5430 Ferrier Street, Montreal, Quebec, a subsidiary of Daystrom, Incorporated or any office of Northern Electric Co. Ltd.

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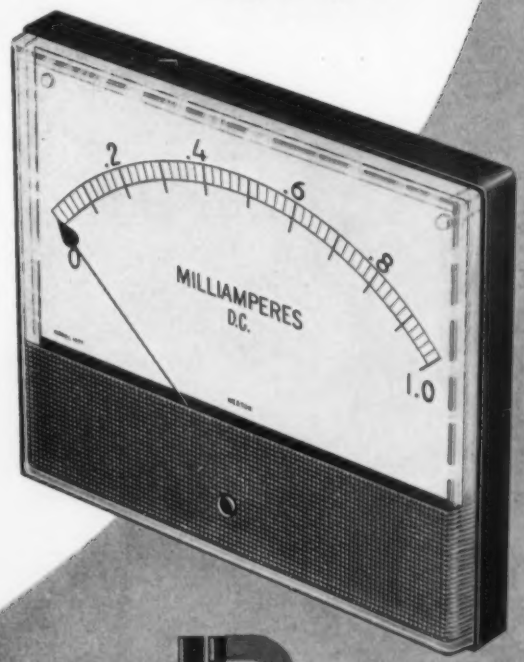


**WESTON** *Instruments*

A DAYSTROM UNIT

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AUGUST
SPECIAL
REPORT

*C.E.E.'s issue devoted to . . .*

# CANADIAN ELECTRONIC RESOURCES for INTEGRATED DEFENCE PRODUCTION

## A COMPLETE PROFILE OF CANADA'S ELECTRONICS MANUFACTURING FACILITIES AND CAPABILITIES.

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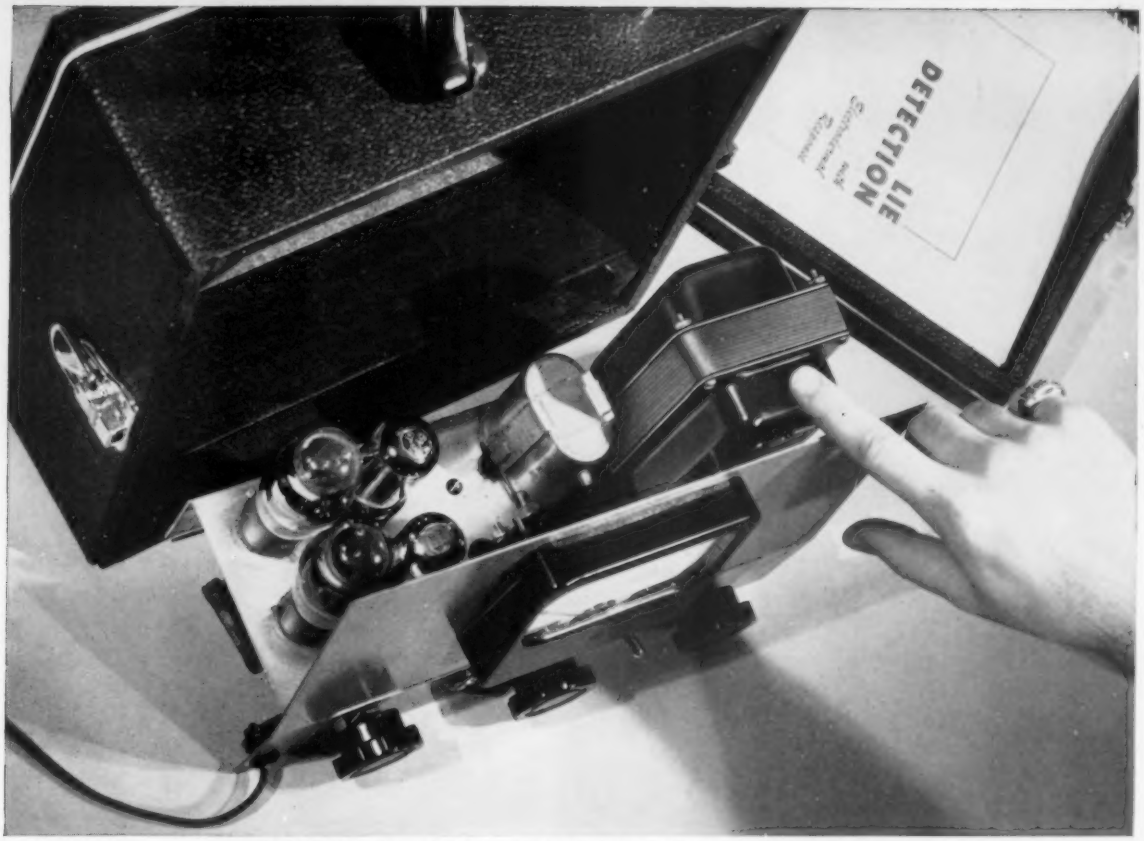


*B & W Associates built in a Sola regulated plate-filament power transformer as an integral component in their portable lie-detection apparatus.*

# Portable lie detector operates accurately with Sola-regulated plate and filament voltages

This sensitive polygraph operates by picking up and immensely amplifying tiny electrodermal responses. It's small wonder that line voltage variations encountered in field operation must be corrected if the responses of the witness are to be measured accurately.

The lie detector's built-in power supply transformer is a Sola Constant Voltage Plate-Filament Transformer which performs this dual function: (1) it supplies plate and filament voltages just as an ordinary power supply transformer would do; (2) it regulates these supply voltages within ±3% even when the line voltage varies over a 100 to 130-volt range.

Besides providing regulation which assures accurate polygraph operation, the Sola transformer protects tubes and components from cold inrush current and from fault currents.

This simple, reliable component costs little more than ordinary, non-regulating transformers. And compared to other types of regulating circuitry used with conventional power transformers, it is considerably cheaper.

The plate-filament regulator is only one of the complete family of Sola Constant Voltage Transformers including such special types as filament and adjustable-output units. More than 40 models are available from stock, and Sola manufactures custom-designed units in production quantities to meet special needs.

***For additional information write for Bulletin 52G-CVE***

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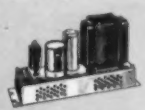
CONSTANT VOLTAGE TRANSFORMERS


REGULATED DC POWER SUPPLIES

MERCURY LAMP TRANSFORMERS

FLUORESCENT LAMP BALLASTS

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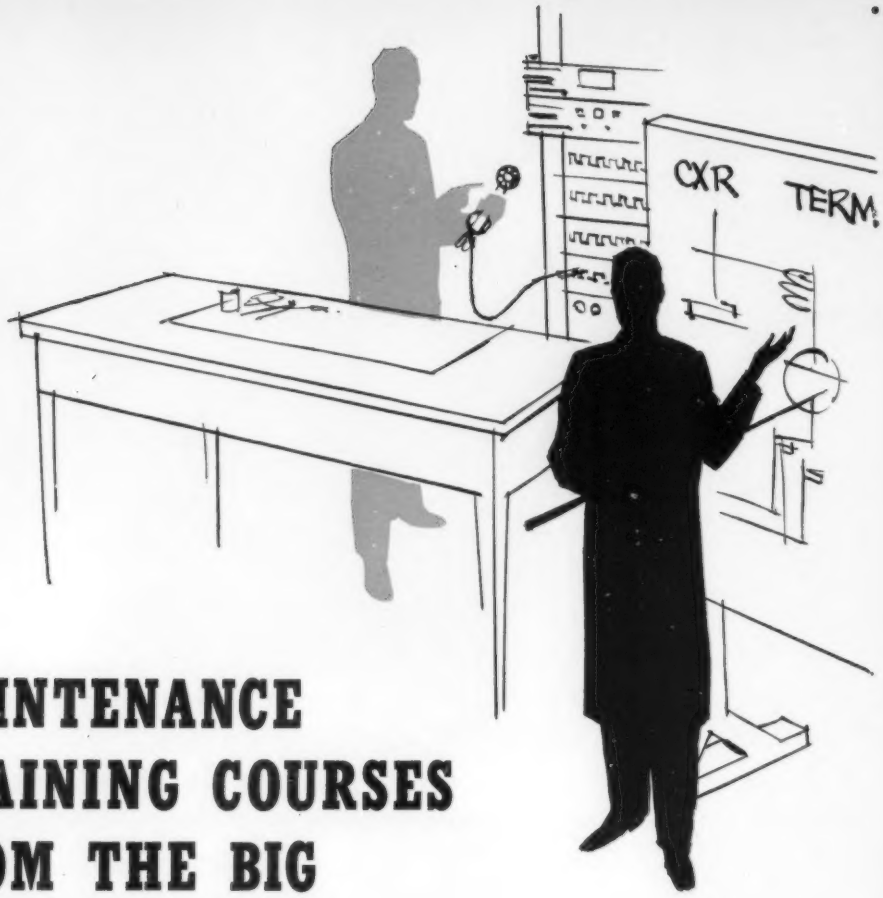


# MAINTENANCE TRAINING COURSES FROM THE BIG TEAM OF TWO

Lenkurt and Automatic Electric are justly proud of the performance standards set by Lenkurt equipment. The comprehensive maintenance training courses offered are among the services designed to assist you in keeping this equipment in peak operating condition.

Practical training in every phase of maintenance of Lenkurt equipment is provided by skilled instructors, using modern, completely equipped classroom facilities.

You are invited to take advantage of this unique service, which is entirely free of charge. Your local Automatic Electric representative will be happy to supply course details and schedules.

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AUTOMATIC ELECTRIC

ORIGINATORS OF THE DIAL TELEPHONE

GENERAL SYSTEM

5918

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# Is "Made in Canada" only a slogan?

Calling on the members of the Electronic Industries Association of Canada to support the "Made in Canada" campaign, R. M. Robinson, retiring president of EIA, recently said: "Whenever we have a choice between a Canadian-made product and an imported product, we should let 'Made in Canada' be a factor in our decision. When we do this we set in motion a chain-reaction which is felt right back to the sources of our raw materials — a reaction that helps in countless ways to raise our standard of living and maintain and stimulate employment for all Canadians."

Mr. Robinson referred to the unemployment that is being caused in the Canadian electronics industry by the rapidly rising rate of importation of foreign radio sets and components, particularly from areas like Japan, where radio assembly wage rates are as low as one-tenth of Canadian average rates for the same type of work.

Just how serious is the situation? At January 1, 1959 there was an estimated 2,000,000 square feet of manufacturing floor space idle in Canadian electronics plants. In the last two years some 2,000 Canadians have lost their jobs in these plants through falling off of orders to support normal production.

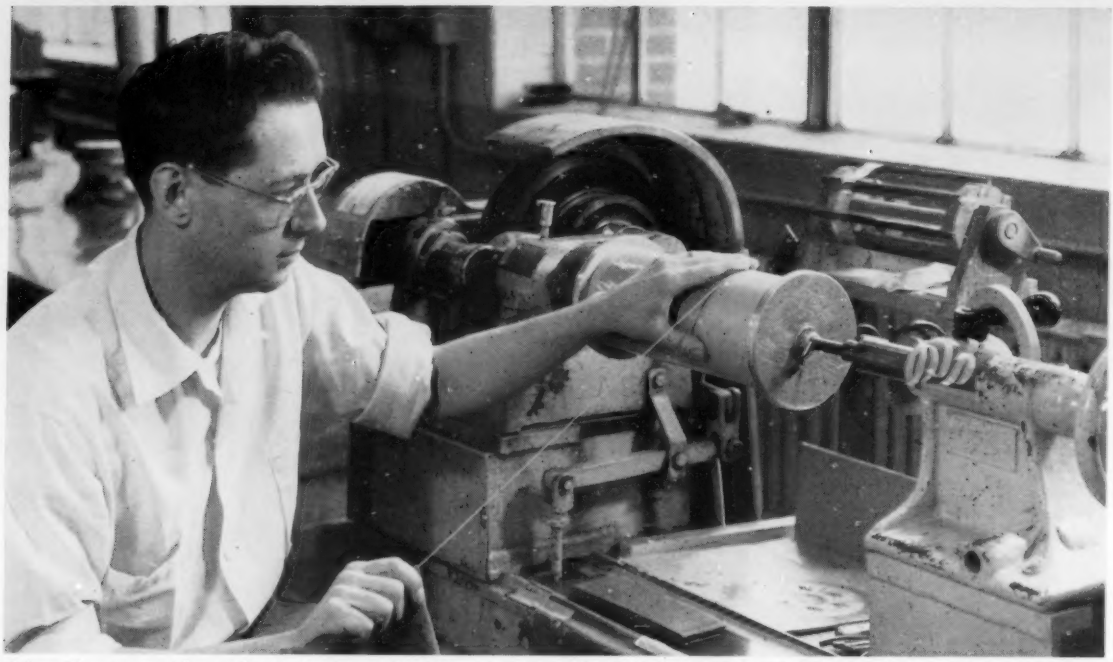
And the causes? During 1958 imported radio sets accounted for 30.5% of all radio sales in Canada. For the first two months of 1959 this figure reached 37%. If this trend is allowed to continue, by the end of this year over half of all radios sold in Canada will be imports.

In 1957, 28.6% of all radio and television receiver-type tubes sold in Canada were imported — with only 210 units from Japan. In 1958, the percentage rose to 33%, with 214,462 units from Japan. In the first two months of 1959 the imports of tubes from Japan exceeded 219,000 units — *this is more than in the whole year 1958*. There seems no doubt that by the end of 1959, far more than one third of all receiving type tubes sold in Canada will be imported.

In 1958 Japan exported 155,000 transistorized radios to Canada, averaging five transistors per set —over 750,000 transistors lost to Canadian manufacturing. Without this base of consumer product transistor requirements, Canadian manufacturers are being forced out of transistor production. This leaves Canada dependent on foreign sources for the transistors needed for vital defense equipments.

EIA has submitted a brief to the Federal Government, requesting their assistance in curtailing these imports. The brief makes several suggestions regarding corrective action, but the lesson for the industry — and for all Canadians — lies in Mr. Robinson's words. It is surely better to pay a reasonable amount more for a Canadian product and keep our jobs in Canada, than to buy a foreign-made product a little cheaper, and perhaps shortly have no job to provide the wages to buy necessities at any price?

**THE EDITOR**



*Solenoid wound with anodized aluminum wire allows accurate field concentration and higher safe operating temperature*

# Anodized insulation permits close tolerance in design work

G. R. PINK, P.ENG.*

*High temperature insulating value of anodized aluminum wire permits operating temperatures high enough to light a cigarette. Oxide layer can be used up to 300 deg. C.*

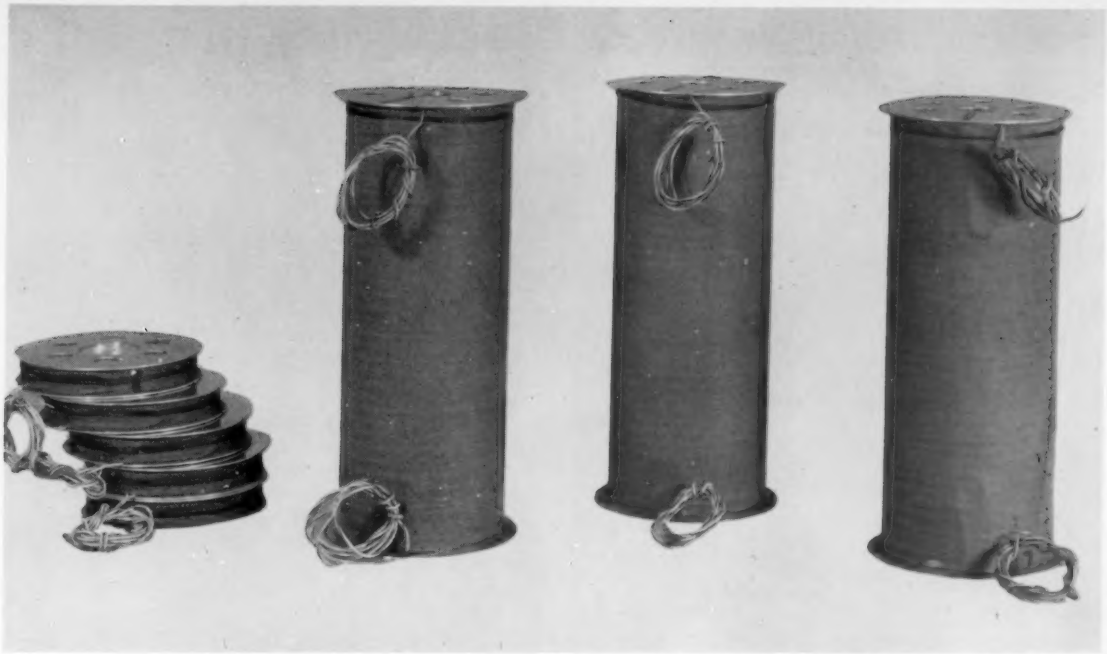
An interesting new engineering development has been achieved through close co-operation between Canadian Marconi Company and the Aluminum Company of Canada Limited. Accurately formed focusing solenoids were needed for the traveling wave tubes in the DQ58 radio relay equipment, and the problems were solved through the use of anodized aluminum rectangular wire.

The DQ58 radio relay equipment has been designed to give large-channel capacity and high quality performance over long distances. Operating in the frequency range of 1700-2300 mc, it can transmit up to 600 telephone conversations or one video program. Duplicate equipment with automatic changeover ensures reliability in excess of 99.99% (less than one hour per year accumulated down time).

Essential to the functioning of the traveling wave tube in the rf amplifier is the correct focusing of the electron beam traveling within the wire helix at the core. Inexact focusing could cause the wire to burn out rapidly. Correct focusing is achieved by establishing a magnetic field exactly coaxial with the helix. Use of the usual varnish insulated round wire for the solenoid concentrator presents two problems: it is impossible to avoid slight variations in winding diameter due to the pitch of the wire and the crevices between windings; the insulating coating must stand up to considerable heat.

Rectangular aluminum wire 0.032 in. x 0.1 in. with an average anodic film of 8.5 microns (Alcan D1SO) satisfied the conditions. It also provided an important subsidiary benefit in the form of weight reduction. The travel-

*Aluminum Company of Canada Ltd., Montreal.



*Solenoids, wound with anodized rectangular aluminum wire are used in Canadian Marconi's radio-relay equipment*

ing wave tube weight was cut from over 100 lb. down to 60 lb. by use of an aluminum-wound solenoid.

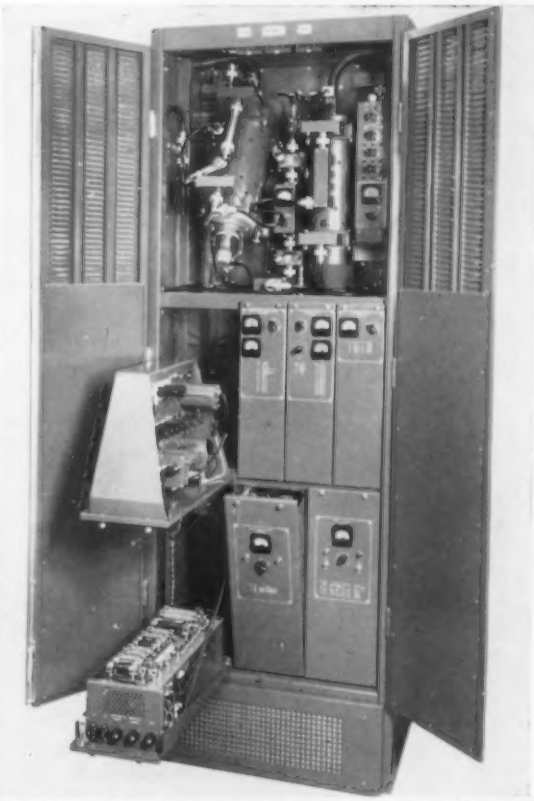
**Oxide forms the insulation**

The oxide coating of aluminum, which forms on the metal immediately it is exposed to oxygen, is a natural electrical insulation. Normally about 0.2 microns thick, it can be artificially thickened by the anodizing process. This provides a coating of amorphous aluminum oxide ($Al_2O_3$) containing small amounts of water and salts. Its structure is cellular, each cell having grown around a pore measuring approximately 1,000 angstroms in diameter. The pores do not reach down completely to the metal, a thin nonporous barrier layer existing at the metal-oxide interface.

It is possible, by using different electrolytes and bath conditions, to vary the form of coating. The wire used by Canadian Marconi Co. features flexible coating which can be bent around radii as small as five wire diameters without flaking. It is also possible to produce a denser coating which is less resistant to bending, but with superior abrasion resistance.

Of paramount interest for potential users of this new insulation is its ability to retain its dielectric properties at extremely high temperatures. The performance of the coating at temperatures approaching the melting point of aluminum were established by winding a number of ceramic bobbins under constant tension with two individual layers of anodized wire. In every case breakdown occurred at approximately 300 volts for temperature variations ranging from room temperature up to 600 deg. C. The lowest reading recorded was 285 v.

Besides having the properties mentioned previously, anodized wire is inert to organic solvents, is uniform in thickness and forms a good base for overcoating with other materials. Continuous anodizing also produces a coating at reasonably low cost. END

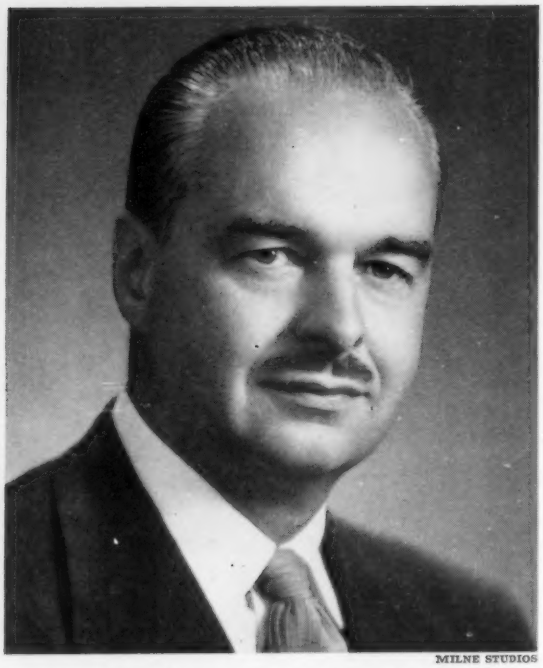


*Canadian Marconi Co. uses anodized aluminum wire in coils of travelling wave tubes in DQ58 radio equipment*

# Recent events show electronics progress

## A survey of meetings and conferences of interest to the industry

ROY GRANT, EDITORIAL ASSISTANT



MILNE STUDIOS

**Stuart D. Brownlee** *was elected president and chairman of the board of directors of the Electronic Industries Association of Canada during the association's recent 30th Annual Meeting at Bigwin Inn, Muskoka, Ont.*

*Mr. Brownlee, secretary and general manager of EIA from 1945 to 1956, is president of Canadian Admiral Corporation Ltd., Port Credit, Ont. He is a graduate electrical engineer and a registered patent attorney.*

*Former positions were in the appliance design and law departments of Canadian General Electric Co. Ltd., and with Canadian Radio Patents Ltd. — he became president of CRPL in 1954. Mr. Brownlee was also Secretary-Treasurer of the Canadian Radio Technical Planning Board from 1945 to 1954.*

### EIA Annual Meeting

A conference made up of the electronics industry, the universities, and government representatives to discuss future research activities was an idea heartily endorsed at a press conference held during the annual meeting of the Electronics Industries Association of Canada.

If such a get-together resulted in co-ordinating and bolstering scientific support programs, the advantages would be tremendous. Increased research activity would help keep our best scientific brains on this side of the border and attract scientists from other countries as well. A stronger voice for international bargaining would, in turn, boost our economic and political status. The ultimate outcome would be increased employment of scientists, engineers and production workers.

Despite setbacks such as increased radio importation and the cancellation of job-holding defense contracts, Canada's electronics industry makes the most of its resources for research. A small Canadian market and narrow profit margins prevent large-scale research projects, but a great deal of development work gets done.

Electronics research is a highly competitive international field, with strong government support in major companies like Great Britatin and the U. S. It is the least expensive, and one of the most important of investments. If Canada expects to expand its economy and its international markets, if it expects to move from its present crib as a raw material exporter to the mature status of manufactured materials exporter, research — pure and applied — will need greater government sponsorship.

However, the industry thinks that the present setup for handling research projects is a satisfactory one, with government agencies and universities doing the bulk of pure research, and industry the bulk of applied research and development. A central industrial establishment might present too many problems in this fast moving, competitive field, especially in the area of patent rights.

The government itself has begun to realize the significance of electronics research work. The cancellation of major contracts caused such a steady migration to the U. S. and Europe of key scientists and engineers that relief action is expected. The industry has already proved that individual product developments can win world markets, and that self-sufficiency in this field is far preferable to dependence on the findings of other countries.

The United States is also beginning to realize this, especially in production sharing for common defense. This nation has shown its good will by slackening its defense procurement regulations. It has dropped the 12% extra duty on foreign orders once imposed under the Buy American Act. Now on a more equal footing, Canadian electronics firms have bid successfully for new work in the form of radar equipment, components, power supplies and various classified equipments.

The past 10 years have seen some remarkable changes in the Canadian industry. Although retiring EIA president Robinson has reason for concern in the rising importation of foreign radio sets, the industry has seen a continued sales growth in this area, despite television. Electronics firms can point with pride to a reversal of inflationary trends in the TV market. They have engineered improved values in TV set design and performance in the face of rising labor and material costs — a trend quite contrary to other durable goods industries. Government action and a "Buy Canadian" attitude by individuals and companies might help the Canadian radio set market regain its status and strength. But the TV picture is assuredly bright and clear for the next 10 years with more innovations and continuing good business over the horizon.

Two developments brought up at the conference — color TV and stereo broadcasting—are still in the nebulous stage. The former must wait upon the commencement of color broadcasting by stations and networks, the latter upon the decisions of the regulatory authorities now studying the matter.

But the case for color TV was left on an excellent

*Antenna for Prince Albert Radar Laboratory was designed by group at Lincoln Laboratory under Dr. J. Hutzenlaub, left; Dr. J. Hogarth of DRB carried out liaison for PARL*

*Mr. H. Weiss, left, chief engineer at Lincoln Laboratory, conceived Millstone and PARL radars. With him is D. R. Hansen, DRB scientist who is officer-in-charge of PARL*

note. When it does arrive, TV dealers will not be able to sell higher-priced color sets with the come-on bargains of the discounter. This unpleasant fellow depends on presold customers for his business and can divorce service to marry profit. But it will take pure slugging from well-informed salesmen to get color TV in the nation's homes; this, backed up with a fair profit and top service in every department.

Other newly-elected officers of EIA of Canada are: J. Key, Aerovox Canada Ltd. — 1st vice-president and chairman of the Components Division; W. F. Wansbrough, Canadian General Electric Co. Ltd.—vice-president and chairman of the Receiver Division; J. D. Houlding, RCA Victor Co. Ltd. — vice-president and chairman of the Electronics Division. Vice-chairman of the three divisions are: D. Knapp, Canadian Stackpole Ltd. (Components); R. J. M. Allan, Addison Industrial Ltd. (Receiver); W. S. Kendall, Computing Devices of Canada Ltd. (Electronics).

**Prince Albert Radar Laboratory (PARL)**

In a 700-acre site outside Prince Albert, Sask., a new radar laboratory is testimony to the co-operation between Canada and the U. S. on joint missile defense programs. President Eisenhower's message, beamed off the moon from PARL's counterpart, Millstone radar at Lincoln Laboratory near Boston, said as much in a tape-recorded playback during the official opening on June 6.

"I am delighted to greet you, Mr. Prime Minister, and the Canadian people, on the occasion of the opening of the Prince Albert Radar Laboratory. The completion of this laboratory constitutes another major advance, along the road of co-operative ventures between our two countries, in defense research and other fields. The transmission of this message by way of the moon, a distance of almost half a million miles, emphasizes the technical importance of your new laboratory, and is a specific illustration of the scientific co-operation between Canada and the United States. The work of this laboratory cannot fail to make a significant contribution in future years toward the solving of mutual problems."

Prime Minister Diefenbaker officiated at the opening of the laboratory.

Sponsored jointly by the Defence Research Board, Ottawa, and the United States Air Force, the new facility will be used to study the effects of the aurora borealis on radar detection of aircraft and missiles. Scientists from the Defence Research Telecommunications Establishment (DRTE), Ottawa, and the Lincoln Laboratory of the Massachusetts Institute of Technology, who represent USAF interests, are collaborating on a research program to reduce the interference effects of the aurora on this type of detection.

The radar equipment at PARL consists of a transmitter, antenna and receivers supplied by the USAF. The high-speed computers have been designed by DRTE and are being built at their labs near Ottawa.

The transmitter uses high-powered klystrons that stand 11 feet high. These give pulses with a peak power in excess of 2 megawatts.

The 84-foot diameter antenna is mounted on top of a 90-foot tower designed for minimum deflection from wind or the sun's heat.

The rotating portion of the antenna weighs approximately 100 tons. It is driven by four 30-hp motors at angular rates up to about 4 deg. per sec. in any direction. The rotation can cover a full 90 deg. in elevation and 360 deg. on the horizontal plane. Orientation accuracy is estimated to be —0.2 deg. under reasonable operating conditions.

Prince Albert, Sask., was chosen as the site for the radar because of its position within the auroral band. In addition, it is near the Institute of Upper Atmospheric Physics at the University of Saskatchewan in Saskatoon, and near the rocket firing range at Fort Churchill in Manitoba.

The PARL staff comprises 10 scientists and technical specialists from DRTE, with an additional five supporting personnel from Prince Albert. The officer-in-charge is Mr. D. R. Hansen, DRTE scientific officer.

**Electronics Parts Show**

Prospective Canadian buyers at the National Electronics Parts Show in Chicago may have been surprised when Ron M. Robinson, president of Electronic Industries Association of Canada urged them to "Buy Canadian." One could assume they were not at an exhibition of U. S. electronic parts and components for this purpose.

Rating the Canadian industry as "second to none in design, engineering and manufacture," Mr. Robinson was "naturally concerned about its growth prospects, particularly with anything that might harm the industry and the 19,500 workers in all parts of Canada that depend upon it for their livelihood."

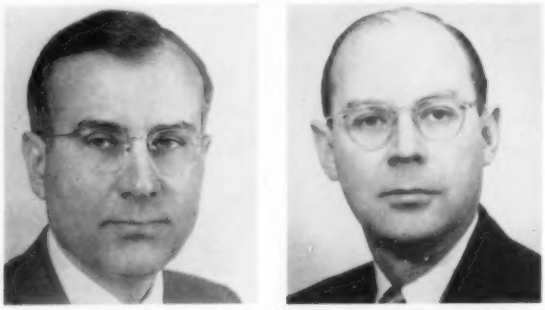
Although the industry had hit a peak of almost $560

million in 1955, it has failed to reach $500 million for the past two years, and "the point of decision is passing us by." In addition to this, some 2,000 workers have lost their jobs and "very serious import conditions are cutting into Canadian electronic production and employment."

Japan, with "wage rates . . . as low as one tenth of ours," and other countries, are now selling goods in Canada at prices Canadian manufacturers cannot match. And while we must compete with an economy based on manufacturing, our international trade agreements are based on exports of raw materials and agricultural products. An opinion that this is a temporary condition was described by Mr. Robinson as "unrealistic and dangerous."

Government action was not enough, he said. Industry too, must accept its share of responsibility by letting "Made in Canada" be a factor in decisions that involve a domestic product and an imported one.

A record attendance by Canadians was set at this year's show with 175 registering at Chicago's Conrad Hilton. E. G. Hill, of Antiference (Canada) Ltd., Toronto, was elected chairman of the Canadian Electronic Sales Representatives at their annual breakfast meeting held during the parts show. He succeeds C. G. Pointon. Also elected were K. G. Davis, J. R. Longstaffe Ltd., Toronto, as vice-chairman, Bruce Lord, Radio Vision Sales Ltd., Calgary, as western vice-chairman, and J. J. MacQuarrie, Toronto, as secretary-treasurer.



*Dr. Robert W. Young, left, U. S. Navy Electronics Laboratory, San Diego, has been named president-elect of the Acoustical Society of America. Dr. Hale J. Sabine, right, Armour Research Foundation, Chicago, will be president for the coming year.*

**Acoustical Society Meeting**

Several hundred physicists and acoustics experts from Canada, the U. S. and other countries gathered in Ottawa for the 57th meeting of the Acoustical Society of America. The meeting, hosted by the National Research Council, Ottawa, featured 19 sessions and more than 150 papers on the latest advances in acoustics. Ten papers were delivered by Canadians.

Topics discussed ranged from new stereophonic instruments to the noise of a B-52 bomber, and from underwater sound to ultrasonics. Included were descriptions of latest developments in: a new artificial larynx; the use of speech recognition computers and machines; shock and vibration from underwater explosions, railroads and earthquakes; traffic noise problems in West Germany and speech science in Japan; noise from fans, typewriters and cocktail parties. Principal speaker at the society banquet of the three-day event was Dr. E. W. R. Steacie, president, National Research Council. He discussed the problems of operating research laboratories, especially those that were government sponsored.

Although the obvious scope of these papers does not permit a packaged condensation, several specific developments should illustrate the new knowledge and versatility of the field. M. R. Shroeder of the Bell Telephone Laboratories Inc., Murray Hill, N.J., described a device that, when inserted between a mike and its loudspeakers, minimizes the squealing acoustic playback in P. A. systems.

One of the most interesting papers was delivered by Hugh Le Caine and John M. Bowsher, radio and electrical engineering division, National Research Council, on the development of a tape recorder for electronic music studios. Such an instrument not only records sound, but can transform it by changing speed or by combining it with other recorded sounds to create a musical composition. Keyboards, rather than knobs, are used. The authors believe that any type of music production would benefit by it.

Winner of the society's Gold Medal was Dr. Edward Christopher Wente, staff member of Bell Telephone Laboratories.

**NCATA Convention**

Increased membership, new accomplishments and projects were highlights of the third annual convention and trade show of the National Community Antenna Television Association of Canada, held for three days at Montreal's Queen Elizabeth Hotel.

Total registration at the meet was 188, with 11 trade members exhibiting. The rapid growth of the association was seen in the fact that the 66 active members and seven trade members for March, 1958, had grown to 90 active and 14 trade since then. These same active members are now operating 193 CATV (Community Antenna Television) systems.

Several NCATA projects were reported completed. Most important, perhaps, was the windup of negotiations with the Bell Telephone Co. leading to a standard form of contract for supply of cable facilities by the firm to CATV operators.

The association succeeded in enlisting the participation of the Canadian Standards Association in committees that dealt with overhead wiring and wire distribution systems. It is also making yards in its efforts to make the tapping of a CATV cable — for the purpose of using the signals without cable — an offience against the criminal code.

Upcoming activities initiated by the board of directors will include a study of standardization of components, cable and equipment used in CATV systems. Another committee will examine the possible effect of boosters, translators and other forms of program reradiation on CATV systems and make recommendations for any action necessary to counter these effects.

Guest speaker Carlyle Allison, a permanent member of the Board of Broadcasting Governors, said it was generally true that the government's television coverage policy is based on extension of Canadian service. However, it was his personal opinion "that reception of TV programs from a transmitting station outside of Canada is better than no television service . . . in isolated pockets . . . which are unlikely to receive service in the foreseeable future by any other means.

"Again . . . it would seem wise for the time being to limit extension of CATV in such circumstances to single-hop microwave to permit further study of its effect on broadcasting," he said.

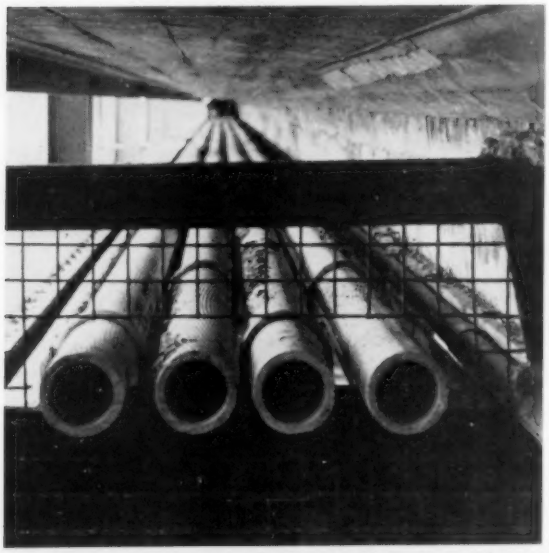
An interesting feature of the convention was the use of a simultaneous translation system using the Multi-Tone method. A power amplifier fits into a wire loop that surrounds the area to be covered. Speech transmitted into the loop is picked up by inductive coupling on small transistorized receivers of the type used for pocket hearing aids. The introduction of simultaneous translation proved a great convenience to the meetings, as at least half of the NCATA members are French speaking. END

# New bridge ends two bottlenecks

Completion of the Burlington Bay Skyway meant one thing to Ontario motorists—the end of a painful bottleneck on the busy Queen Elizabeth Way between Toronto and Niagara Falls.

To The Bell Telephone Company of Canada the Skyway meant much more. It meant an opportunity to get trunk cables across a busy, relatively shallow waterway in such a way that future breakdowns could be cut substantially—and probably eliminated.

In the past, cables had crossed the waterway by two different methods. Submarine cables were used originally, but disruptions of service were much too frequent. Dragging anchors and dredging operations played havoc with the cables.



*Transite conduit carries telephone cables across Skyway*

Eventually The Bell Telephone Co. switched to use of Ontario Hydro power transmission towers to get their cables across. This showed a marked improvement, but some disruptions continued due to climatic conditions.

When the Ontario Department of Highways planned the Skyway, Bell Telephone officials saw a possible end to their troubles. They asked Foundation of Canada Engineering Corporation Limited (FENCO), designers of the bridge, to incorporate into the plans facilities for carrying Bell cables.

The planners settled for a single tier ladder rack method of carrying four conduits under the sidewalk deck. This method, while preserving the clean lines of the bridge design, offered initial economy since it required supports only at intervals of eight feet for the ladder rack.

Because of the spacing of ladder cross members, it was essential that the conduit used be of a completely rigid nature without cold flow characteristics. FENCO recommended standard transite conduit manufactured by Canadian Johns-Manville. The 3-in. duct was supplied in 10-ft. lengths with simple expansion joints.

At the central section of the bridge, where the bridge expansion structure is installed, the duct line was fitted with a compound expansion joint consisting of two normal expansion joints and a sleeve. This was needed because the conduit has a much smaller coefficient of thermal expansion than has the steel in the bridge.

The duct line enters the bridge through the north pier where it is housed in a steel mesh cage embedded into the structure under the sidewalk deck. This solid footing within the safety of the cage was designed to simplify cable pulling, and add a safety factor to installation.

The transite conduit, mounted under the sidewalk deck, is completely hidden from public view. In addition, it protects the telephone cables from mechanical stresses and the weather. END

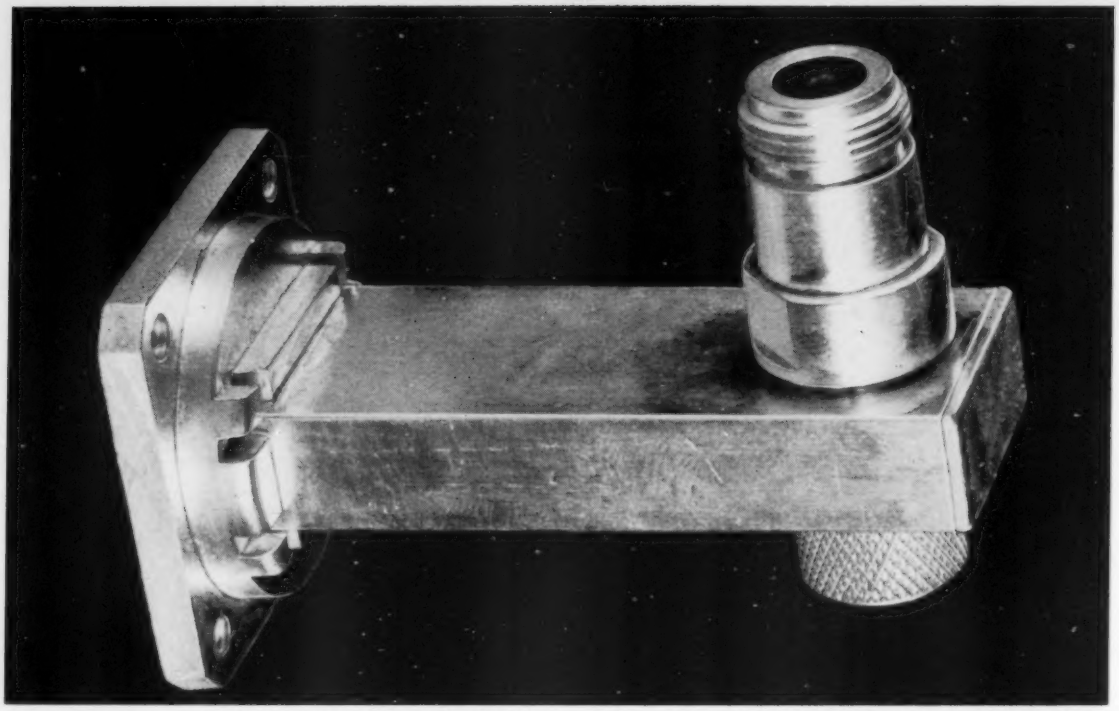


*Fig. 1. Frequency multiplier mount is designed for third harmonic output from 8,200 to 9,600 mc. It uses IN23E diode.*

# Broadband harmonic generator converts from S-band to X-band

K. A. STEELE, MEM. IRE*

**Harmonic generation is useful when sources at the desired frequency are not available and also to simplify the design of test sources which must provide an output at widely separated frequencies. The multiplier mount described is intended for third harmonic X-band output from 8200 to 9600 mc when operated with a pulsed S-band source. The conversion loss is 20 db for input power levels of from +10 dbm to +25 dbm with a 1N23E crystal diode as the non-linear element. A comparison with some other crystals is given.**

Frequency multiplication in the microwave region is often used when suitable sources of the desired frequency are not available. The attention of many workers has been directed mainly toward obtaining useful amounts of harmonic power at K-band and higher frequencies. There are, however, some advantages in using harmonic generation to obtain X-band power from an S-band source.

If it is desired to provide a microwave test source to cover the frequency range from S-band through X-band, a single klystron can be used for a portion of both S and X-bands. For applications in which low power, integral-cavity type klystrons are suitable, this will result in fewer klystrons being required. The coupling to the klystron, level setting attenuator, transmission line to the components being tested, etc., may all be designed for S-band only. If the stability of the microwave power is an important consideration and a flexible transmission line from the oscillator to the components under test is necessary, frequency multiplication has the additional advantage that only S-band energy need be transmitted through the connecting cable.

The multiplier mount shown in Fig. 1 is designed for third harmonic output from 8200 to 9600 mc. It is designed to use a 1N23E diode as the non-linear element. No adjustable tuning means are required. The mount was designed as part of test equipment for field use under conditions where a minimum of equipment controls is preferred. S-band klystrons such as the 726 A, B, C and 6043 are used to provide the fundamental power for the multiplier. All tests with the mount have been made under pulse conditions at a duty ratio of about 0.001 (1usec to 2usec pulse length). Under these conditions the klystrons may be beam modulated to much higher peak output power than their c.w. ratings[1].

*National Research Council, Ottawa.

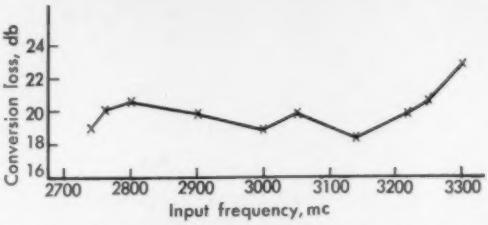



*Fig. 2. Variation of third harmonic conversion loss and frequency at 20±2 db above 1 milliwatt*

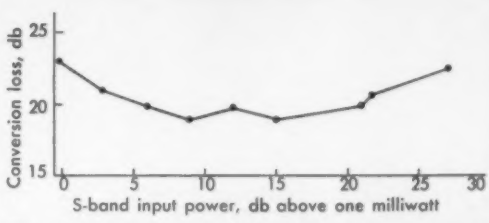



*Fig. 3. Variation of third harmonic conversion loss and power level at frequency of 3,000 mc.*

Figures 2 and 3 show the variation of conversion loss to third harmonic with frequency and power level. The conversion loss is nearly constant at 20 db within the input frequency range of 2700 mc to 3300 mc and for input power levels from +5 dbm to +25 dbm. The measurement of conversion loss was made with equipment and connections as shown on Fig. 4. S-band input power and X-band output power were measured by the heterodyne method[2].

No tuning for optimum impedance match at input or output of the multiplier was made for the results shown on Figures 2 and 3. A small increase in third harmonic output may be obtained if tuning at input and output is done. For input power levels between +10 dbm and +25 dbm the increase in ouput may be 3 or 4 db and is mainly due to improvement in the impedance matching which can be made on the X-band side of the mount. The input vswr is quite low when using a 1N23E diode within these input power levels, even when no tuning device is used.

Mechanical details of the multiplier mount are shown in Fig. 5. A quarter wavelength choke is incorporated at the S-band input to reduce the amount of harmonic power coupling back out the input transmission line. The broad dimension of the 0.900 x 0.400 inch X-band waveguide is reduced to 0.800 inch for most of the length of the mount. This was done to increase the waveguide cut-off frequency and thereby reduce the second harmonic output. Tests indicate that the second harmonic is at least 20 db down relative to the third for input frequencies below 3200 mc and 15 db down from 3200 to 3300 mc. If S-band input frequencies higher than 3300 mc are used an increasingly higher proportion of the output of the mount will be second harmonic unless a high pass filter is used.

Several workers have reported on the relative efficiency of harmonic generators for various bias conditions of the diode including open and short circuit. Their results indicate there is considerable variation in the optimum bias conditions for diodes of different types and even among units of the same type. Tests on IN23E diodes in the broadband mount showed that the highest conversion efficiency to third harmonic is obtained with the diode short circuited to dc. This requires the input transmission line to be grounded at some point (usually the grounded output coupling loop of the klystron source). Under open circuit conditions the third harmonic output is down from 10 db to 15 db. Operation with a dc bias on the diode does not cause a significant improvement in output.

Tests have been made with other diodes of the 1N23 series. Table 1 gives a comparison of 1N23B and 1N23C diodes with a 1N23E.

Although only one 1N23E was used in the comparison, other measurements with several units of this type indi-

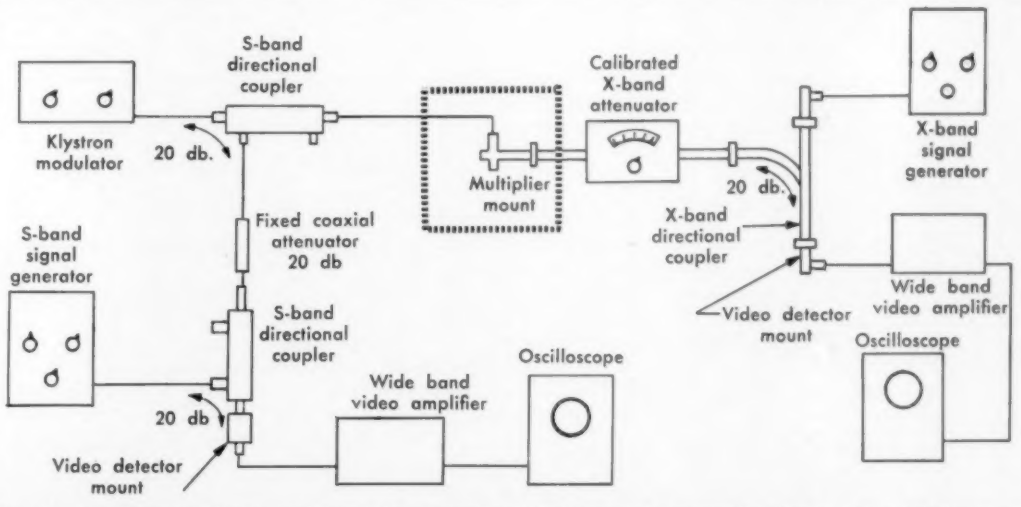



*Fig. 4. Arrangement of test equipment for measuring third harmonic conversion loss in the multiplier mount*

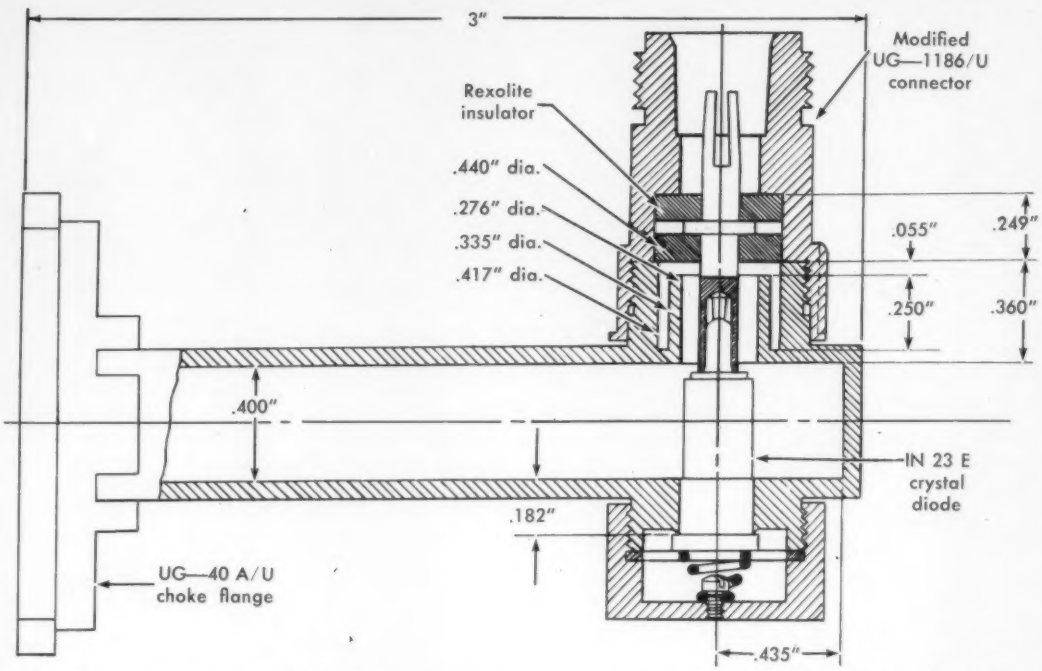



*Fig. 5. Cross sectional view of the third harmonic generator for multiplying signals from S-band to X-band*

cate that the spread in performance of a group of 1N23E diodes is at least as narrow as for 1N23C diodes when a dc return is used. The multiplier mount was designed for a 1N23E diode and this partly explains the much lower harmonic output with 1N23C or 1N23B diodes. A much larger variation in performance among units is evident with the 1N23B's compared to the 1N23C's. There is also a significant difference between 1N23B diodes made by two different manufacturers. The Kemtron diodes generally had a higher third harmonic output when open circuited to dc, whereas the Sylvania units operated best with a short circuit. Open circuit tests were made by isolating the cap end of the diodes from the waveguide ground with a thin rexolite sleeve. END

**Acknowledgement:**

The author is indebted to Mr. W. L. Haney and Mr. A. Staniforth for their advice in the design of the harmonic generator described in this paper.

| Diode type | Short to dc db | Open to dc db | Number tested |
|---|---|---|---|
| IN23E | 0 | —15 | 1 |
| IN23C | —5 ± 2 | —9 ± 3 | 6 |
| IN23B (Kemtron) | —9 ± 4 | —8 ± 2 | 10 |
| IN23B (Sylvania | —7 ± 7 | —10 ± 4 | 10 |

*Tabe 1. Third harmonic output of IN23B and IN23C diodes relative to the output of a IN23E diode shorted to dc.*

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*Banks of reflectors stand at Cape North, Nova Scotia, and Red Rocks, Nfld., on opposite sides of Cabot Strait*

## 69-mile water hop was a major obstacle, but . . .

# Microwaves have bridged Cabot Strait

IAN R. DUTTON, ASSOCIATE EDITOR*

Old man winter has just fought a $9,000,000 battle in Newfoundland.

He lost!

His opponents were installation crews from Canadian National Telegraphs, but the real winners are all the television viewers across Canada.

Despite the severest winter in over 30 years along the Atlantic coast the new microwave network linking Newfoundland with the mainland of Canada went into service several months ahead of the original schedule. The speedup made it possible for TV audiences to watch Queen Elizabeth land at Torbay airport in Newfoundland on June 18, to begin her Canadian tour.

Earlier, co-operative plans of CNT and CBC called for live television into, but not out of Newfoundland by June.

J. S. Ford, chief engineer of Canadian National Telegraphs, said construction of the network, incorporating what is believed to be the longest microwave water hop in the world, was the largest and most difficult job ever tackled by CNT engineers. Spanning the 69 miles of Cabot Strait between Nova Scotia and Newfoundland has been a major achievement in electronics engineering.

Planning for the network started in the fall of 1955, when CBC asked the CNT to submit a proposal to extend television facilities from Sydney to St. John's on a competitive tender basis. Its construction route was dictated by CBC needs, plus CNT's commercial requirements. Sixty telephone circuits, which provide for expansion to 600, are incorporated in the system.

Canadian National Telegraphs was awarded the contract in the spring of 1956 and 54 of the company's engineers were assigned to planning and construction. During 1956-57 radio tests of the proposed route, along with surveys of terrain and a layout of roads required, were completed by firms specializing in these phases of the big project.

Work crews began clearing repeater station sites and

*Based on information supplied by Canadian National Telegraphs.

*The TV tower at Corner Brook, Newfoundland, stands more than 230 feet high. CBC relay station will serve city*

building roads in the fall of 1957. Orders for the complex equipment were placed the same year and its installation started in August of 1958.

The system includes 22 repeater stations, 20 of them in Newfoundland. Tower heights on the island vary from 82 to 235 ft., with the combined height of all of them more than half a mile. In addition, 26 buildings have been erected with a total floor area of more than 35,000 sq. ft. Also included in the over-all installations are 40 diesel units, capable of generating more than 1,000,000 watts of electric power.

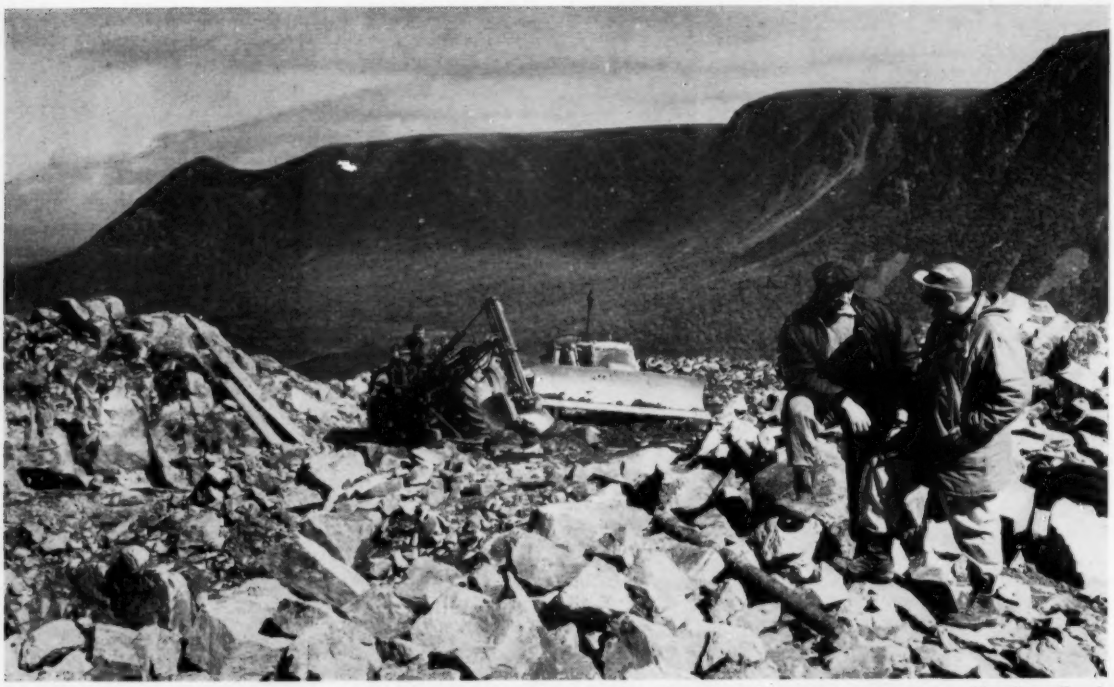
At three of the repeater stations, located at Corner Brook, Gander and St. John's, terminal facilities will be provided for the reception and transmission of television programs. At Stephenville and Grand Falls "drop repeater" stations will enable programs to be received, but not transmitted.

The system will provide three channels of communication into Newfoundland from the mainland, one each for Canadian Broadcasting Corporation television programs, for CNT telephone and telegraph service, and for use as a standby. In the opposite direction there will be one channel for commercial traffic and a standby which can be used for TV when the occasion demands.

The microwave equipment was manufactured by Standard Telephones and Cables Manufacturing Co. Ltd. and installed by CNT staff. Provision of power has been a problem. Generators are used at most of the sites because power is not available from commercial companies.

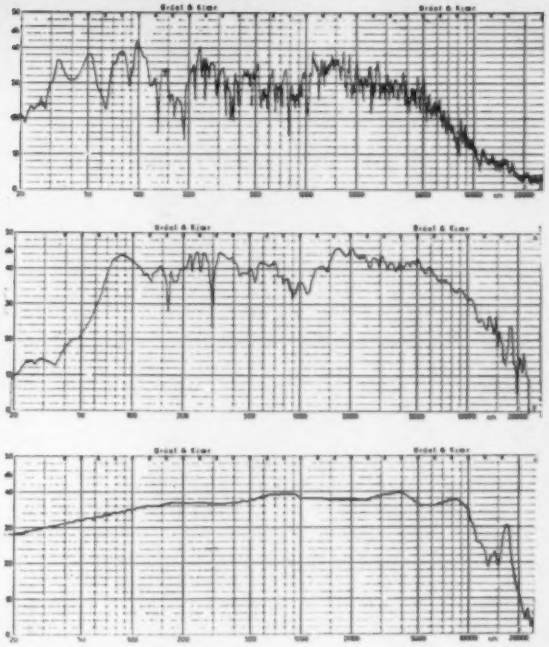
Stations at Cape North, on the tip of Cape Breton Island, and Red Rocks in Newfoundland span the 69 miles of Cabot Strait. Space diversity is used to overcome signal fading.

This microwave link now makes it possible for the CBC to provide television coverage from Victoria in British Columbia to St. John's in Newfoundland, via microwave. END



*Installation crews had to work in rugged terrain when putting in the microwave stations in Newfoundland. They also had to contend with the severest winter in over 30 years. Project was finished in time for Queen's visit*

# Earphone provides good frequency response 150



A new high-fidelity and stereo aerphone (trade name: Live-Tone) has been developed by the National Research Council, Ottawa, and placed in production by Sharpe Instruments Ltd., Willowdale, Ont. A photograph and specifications were published on page 25 of CEE, March 1959, but the following interesting data has been released since that time.

The top graph shows the response of a good speaker system used in an L-shaped living room. The middle graph shows the same speaker system in an acoustically dead room, while the bottom graph shows the response of the circumaural earphones.

Frequency response is 20 cps to 15,000 cps; flat to 12,000 cps and down 4 db at 15,000 cps. Impedance is 6.4 ohms for each phone: maximum power level is + 100 db, each phone; external noise attenuation is —40 db at 1,000 cps or higher.

# Electronic control operates photographic enlarger 151

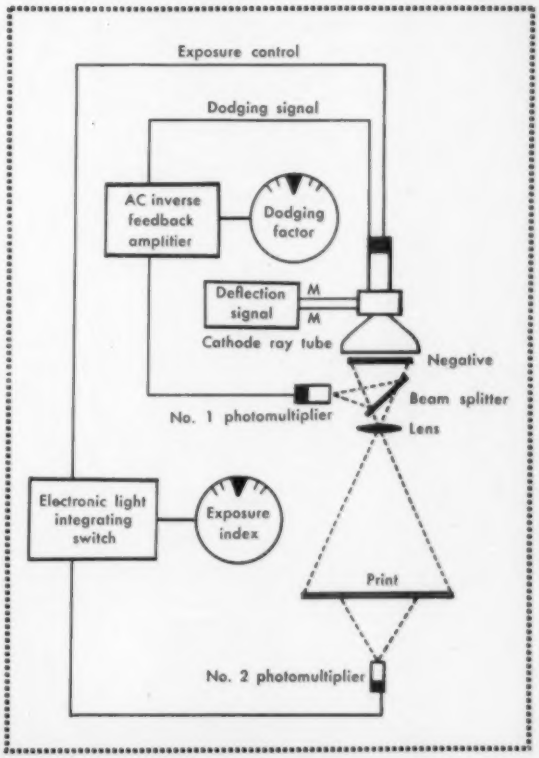
The art of dodging, or shading, with the hands or cotton wool on a wire has been used in the photographic industry for many years, but these techniques of print control are limited by the skill of the operator. They are limited, also, to control on relatively large areas of the print. An alternative is some form of masking or retouching which is laborious and expensive.

Automatic shading and automatic exposure control are accomplished in the E.M.I. Electronic enlarger EP 10 by using a scanning light beam from a cathode ray tube as a light printing source. When the exposing spot of light from the crt encounters a dense region on the negative it becomes brighter. Conversely, brightness of the spot is reduced for thin regions of the negative, thus producing maximum print detail in both the highlights and shadows.

A light integrating system terminates the exposure automatically to produce uniform pre-set print density without adjustment from widely varying negative densities.

The scanning spot from the crt passes through the negative, then part of it is reflected by the beam splitter to fall upon the No. 1 photomultiplier. This signal is used to modulate the crt to compensate for the excessively light and dark areas on the negative. Mounted beneath the paper easel, the No. 2 photomultiplier produces a signal for the light integrating switch. When adequate exposure has been made, the enlarger is turned off. The No. 2 photomultiplier can be made to view the entire print area or a small portion. This permits accurate control when matching the density of specific areas in a sequence of negatives.

This system was designed by LogEtronics, Inc. in the U. S. Further development and manufacture for European markets were carried out by E. M. I. Electronics Ltd.



# New system permits aircraft to land in dense fog 152

Fog may no longer be a hazard in aircraft landings, nor the costly cause of 90 percent of airplane diversions, should Britain's new automatic landing technique be adopted internationally.

The story behind the new automatic landing system goes back over five years of collaboration in design and testing by the U. K. Ministry of Supply's Royal Aircraft Establishment and Pye Telecommunications Ltd., of Cambridge.

Pye's I. L. S., (Instrument Landing System), which forms the basis of the automatic system, depends on radio beams to bring the aircraft down as close as 70 feet above the runway; a magnetic field induced by cables running along the runway then brings the aircraft to touchdown.

This remote control system depends on radio guidance supplying information of the aircraft's position in relation to a path in space, and a control system which can use this information to manoeuvre the aircraft. A coupling unit computes the manoeuvre needed to keep the aircraft on the flight path, and this is carried out by the autopilot.

Down to a certain point, the aircraft's approach is guided by radio beams and then azimuth guidance is switched automatically from the landing system to a magnetic cable guidance system for the next stage. Two magnetic cables, just beyow ground level, run some 5,000 feet from the approach end of the runway along either side of the centre-line. Equipment in the aircraft detects the magnetic fields and uses them to bring the aircraft in toward the centre-line with an accuracy of better than five feet.

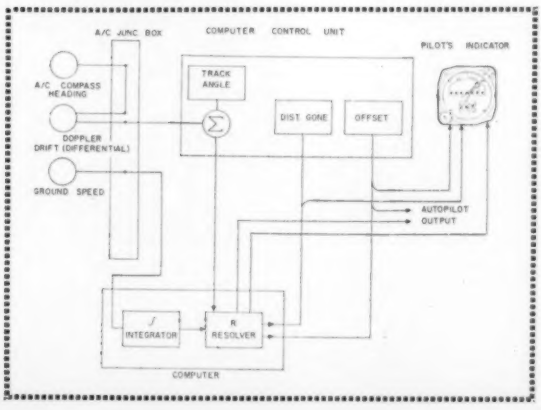
Finally, a radio altimeter is used for the "flare-out" (leveling off to land); a control mechanism maintains a constant speed during the approach and gradually closes the throttles during the flare-out.

# Canadian navigation system for commercial airlines 153

The Skyline navigation system, developed by Computing Devices of Canada Limited, is to be sold internationally by the Bendix Aviation Corporation. The first four sets produced were turned over to Bendix representatives recently.

The Bendix Radio Division has also been licensed to manufacture the Skyline system.

Skyline is a dead-reckoning navigation system developed to meet the requirements of commercial airlines. Inputs from the gyro compass and doppler radar are fed to an eight-pound electro-mechanical analogue computer. The computer continuously computes the position of the aircraft with respect to a preselected track, and presents to the pilot his position in terms of miles from start or last turning point, miles to destination or next turning point, and miles right or left of track.




In normal flying, the Skyline computer is coupled to the automatic pilot, thus providing automatic course corrections. Should a pilot be forced to deviate from his track by a storm, the automatic pilot and Skyline combination will take him back to his track in an optimum approach. Returning to track in an optimum approach is automatically accomplished by computer signals to the autopilot. When flying on track the Skyline provides automatic course corrections to the autopilot.

In the event of doppler failure, Skyline continues to provide navigational information based on the last found drift and ground speed until a change in course is made. With an optional Wind Triangle Computer, the wind speed and velocity is continually available to the pilot or navigator, and if the doppler fails, the system continues to operate as a pure dead-reckoning system using the last found wind. This Wind Readout feature is expected to be of great value to meteorologists, since aircraft will be able to report winds conveniently and accurately without plotting or calculation from any part of a flight.

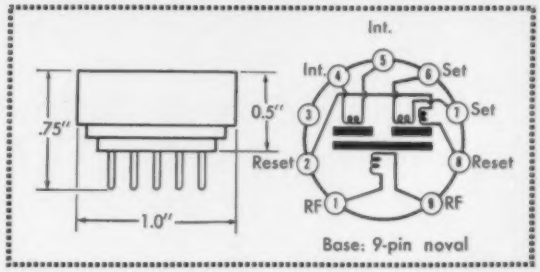
Skyline is made up of three separate units weighing in total less than 15 pounds. Heart of the system is the computer, which is a standard short half ATR rack-mounted unit. The other two units are cockpit instruments. The Computer Control Unit displays Track Angle, Distance Gone from 0 to 999 miles, and Offset Left or Right from 0 to 99 miles. The Pilot's Indicator indicates Relative Track, Offset, and Distance to go from 0 to 999 miles.

# Data processing unit is solid state component 154

The Potter Instrument Co. Inc., type MPT-1 Magnistor is a solid state magnetic component composed of inert materials in a versatile arrangement. High retentive ferrite combined with a high permeability, low retentive ferrite is employed. Originally developed for data processing applications, it is an eight terminal device.

SET input terminals provide access to the high retentive ferrite for data storage as with conventional magnetic ferrite cores. The associated RESET winding when actuated dissipates the stored magnetism. The alternate states of magnetism resulting is evidenced by a two state change of inductance of an R. F. signal winding. This is indicated through the medium of an R. F. signal.

The INT. (interrogate) winding is associated with the high permeability ferrite and effects an identical change of the R. F. signal winding inductance; however, with the lack of magnetic retentivity the response is proportional to the application of current to the INT. winding. When both magnetic circuits are considered in combination the effects of each with respect to the other is of a complementary nature. This result reveals an identity to the half adder (less carry) that is employed in digital computers.




# Programming method speeds tool production 155

New programming methods, evolved by engineers at E. M. I. Electronics Ltd.'s Hayes laboratories, now make it possible to produce first-class dies on milling machines, direct from the drawing, without the use of an external computer.

Special mathematical techniques were devised to provide continuity in "blending" between the co-ordinates shown on the normal blueprint and produce fully three-dimensional work pieces. Punched tape feeds instructions into a built-in computer which controls the unit.

This system gives several advantages over the conventional method of diesinking from mahogany or metal models.

For a typical medium-sized product, the tape can be programmed in about half the time required to make a wooden prototype. As girl programmers can be employed instead of skilled model-makers, the cost per hour is also greatly reduced. It is found in practice that the machining time too is considerably less than by normal methods.

The new system ensures a consistent accuracy of ± .002 in.—much greater than could be achieved by the use of wooden models to an accuracy of ± 1/64 in. and subject to subsequent swelling or shrinkage.

Forging, casting and plastic mouding dies can all be produced on machines equipped with the E. M. I. system. Turbine blades, car rear lights and telephones are just three examples of the type of articles for which dies can be produced more efficiently.

# Environmental test chamber is 42 feet long 156

Construction of a $500,000 environmental test chamber, believed to be the biggest single unit ever built to simulate flight conditions of supersonic aircraft and missiles, has been completed by Tenney Engineering, Inc., of Union, N.J., for McDonnell Aircraft Corp., St. Louis.

The unit is 18 ft. high, 18 feet across and 42 feet deep; weighs 125 tons and has a temperature range of —100 F to + 1,200 F, with an ultimate altitude of 125,000 to 150,000 feet.

Walls of "Old High and Mighty" are two feet thick, including a foot of newly developed insulating material capable of withstanding the extreme temperature ranges.

With a full opening door, itself weighing eight tons, the chamber has 14 x 14 x 35 feet of clear workspace.

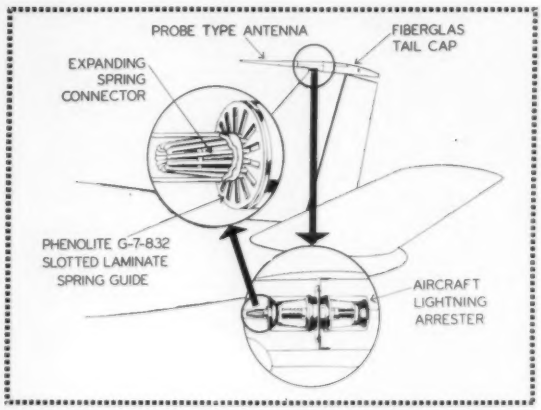
It can simulate ram airflows up to 100 pounds per minute at 75,000 feet and at various temperature conditions, and can dissipate a live heat load equivalent to 30 horsepower ataltitude conditions while maintaining a temperature of — 80 F.

# Laminate aids installation of lightning arrestor 157

In developing a new lightning arrester for use with the latest probe type aircraft antennas, the manufacturer incorporated into the design an unusual "expanding spring" method of fastening the unit to the antenna.

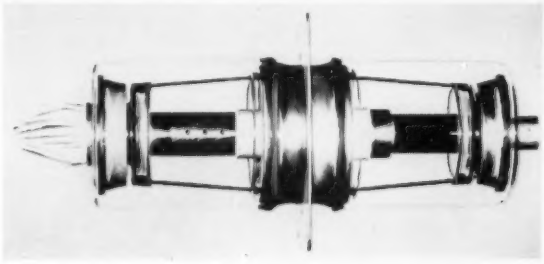
The new arrester utilizes 15 phosphor bronze spring elements to provide a slide-in, press-fit assembly with the plane's tubular aluminum radio antenna. The arrester's fastener design permits a fast, positive electrical connection to the antenna.

The material chosen to serve as a spring guide was Phenolite G-7-832, a silicone glass-fabric laminate made by National Fibre Co. of Canada, Ltd. The 1.75 inch diam. guides are punched from 0.0625 inch stock and have 15 slots to accommodate the spring elements. Assembled into the top brass piece, the laminate disc rests on a shoulder and is staked into permanent position. Once the spring elements are assembled — connected physically and electrically to the centre tube — their ends can be moved in and out on a guided, insulated path in the slots with no danger of touching any other metal surface. The expanding-contracting action of this unusual fastener design makes possible the fast, positive connection between the lightning arrester and the antenna.

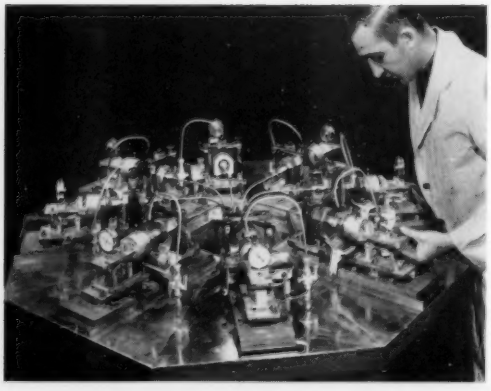



Arrester eliminates lightning hazards by guiding the lightning current from struck antennas through a preferred path to the structure of the aircraft, thereby preventing it from entering and damaging interior circuits. To do this, it employs protective gaps in a hermetically sealed chamber equipped with a ceramic capacitor. The capacitor permits the flow of radio energy between the antenna and the transmitter while, at the same time, acting as a barrier to lightning discharges.

Designed to operate at altitudes up to 50,000 feet and at temperatures ranging from -80 deg. F. to + 160 deg. F., this aircraft lightning arrester will safely discharge lightning strokes having peak current as high as 100,000 amperes and 200 coulombs charge. The device weighs 7 pounds, 3 ounces.



# Ultrasonic machine has eight operating stations 158



Up to 8 ultrasonic machining operations can be carried on simultaneously on this multiple-station Sheffield-Cavitron ultrasonic machine tool, or each station can be operated independently.

Materials for ultrasonic machining include germanium, silicon, ferrite, glass, quartz, and similar hard brittle materials and metals.

A single magnetostrictive transducer mounted in the well of the table transmits 20,000 ultrasonic machining strokes per second to each station by means of the curved cylindrical ultrasonic transmission lines. A remote 1,000 watt high-frequency electronic generator drives the transducer.

Each station accommodates a cutting tool up to 1.08 in. in diameter, to machine workpieces to .050 in. depth.

The Canadian representative is A. C. Wickman, Ltd., Toronto.

*For your library*

# Book on physical laws may help solve many research problems

**Physical Laws and Effects**

*C. Frank Hix, Jr. and Robert P. Alley; John Wiley & Sons, Inc., New York; 291 pp.; $7.95.*

Have you ever been working on a difficult problem and tried to solve it through a new approach, only to find that you were floundering for lack of information and ideas on basic principles? If so, you will really appreciate this new compilation of familiar and unfamiliar laws and effects.

Each "law" is described, then illustrated with typical examples of its application or effect. The order of magnitude is given in equation form and a good list of references allows the reader to delve further if desired.

The book uses a triple cross reference system to make it easy for the reader to find the information he needs. The major section of the book is a description of the laws and effects. This is followed by a cross reference by physical quantities, and a cross reference by fields of science.

The only real defect is the limited scope of the book. However, the authors have recognized the problem and are continuing to build their compilation.

**Hi-Fi Year Book — 1959 Edition**

*Editor: Miles Henslow; Miles Henslow Publications Ltd., 99 Mortimer St., London, W.1, England; 240 pp.; $1.50 approx., postage paid.*

This is the fourth year of publication of the Year Book and once again it has been greatly enlarged. The 14 directory sections include specifications, prices and manufacturers' addresses covering the full range of British audio equipment. There are over 1,000 directory entries, including more than 450 photographic illustrations and 25 diagrams.

Additional editorial features deal with stereo pickup manufacture, loudspeaker impulse-testing, trends in amplifier and preamplifier design, and the use of microphones.

**Principles and Applications of Electron Devices**

*Paul D. Ankrum; International Textbook Co., Scranton, Penn.; 667 pp.; $12.*

Reviewed by H. C. Ratz, University of Saskatchewan, Saskatoon, Sask.

This is an engineering college textbook aimed at introducing electronics from the circuit analysis viewpoint. Typical electronic circuits are used as examples, but are kept secondary to the more general analytical approach which provides background for a wide range of problems.

The fundamental physical characteristics of electronic devices are introduced by way of electrostatics, electron ballistics, cathode ray beams, and electron emission phenomena. This leads naturally to gaseous conduction and vacuum diodes. Work on rectifier and filter problems follows in which considerable effort is spent on the fundamental problems of equivalent circuits and non-linear circuits. The control of gas tubes and the vacuum triode are introduced next, and the necessity shown for multi-element tubes. Small signal amplifiers, large signal amplifiers, and oscillators are analyzed using both vacuum tubes and transistors to emphasize the basic circuit principles.

This book covers an impressive range of topics in fundamental electronics with an exceptionally clear and comprehensive presentation. It is outstanding as a basic reference work and as a text in the understanding of the principles of electronics, and in the application of those principles to electron devices. Students will appreciate the special care taken to use a consistent and unambiguous notation throughout.

**Three Dimensional Dynamics — A Vectorial Treatment**

*C. E. Easthope, M.Sc., Ph.D.; Butterworth & Co. (Canada) Ltd., Toronto; $7.80.*

Reviewed by R. H. Parker, Toronto.

There are four ingredients which a good textbook should have to be suitable for individual study (rather than as a reference). These are a comprehensive text, worked examples, problems for the reader to solve, and a set of answers to the problems.

This text on three dimensional dynamics does have a comprehensive text and the author has, in many cases, taken the trouble to work out his proofs in detail. He does not stop in the middle of an involved integral, leaving the student to complete it "for exercise."

Some twenty-five well-presented examples are contained in the book, and one should acquire a good knowledge of the subject by working all the problems conscientiously.

One objection was the use of an inverted V symbol instead of an x for the cross product. There appears to be no need for such a change.

Students in electronics will find the book useful as a basis for understanding three dimensional particle motion.

**International standards for electron tubes**

Two international standards recommendations affecting electronic tubes and valves have just become available from the American Standards Association. They are IEC Publication 67 (third supplement) and IEC Publication 100.

The third supplement to IEC Publication 67 — Dimensions of Electronic Tubes and Valves—provides a basis for the interchangeability of electronic equipment among the 33 nations participating in the work of the International Electrotechnical Commission (IEC).

IEC Publication 100 lists recommended methods for the measurement of direct interelectrode capacitances of electronic tubes and valves. The methods apply to receiving tubes, cathode-ray tubes, gas tubes, phototubes, photocells and multiplier types, and high-power vacuum tubes.

Copies of IEC Publication 67 (third supplement) at $2.40 each and of IEC Publication 100 at $4.00 each are available from American Standards Association, Dept. PR 37, 70 East 45th St., New York 17, N.Y.

**Conductance Design of Active Circuits**

*Keats A. Pullen, Jr., Eng.D.; (John F. Rider Publisher, Inc.); Charles W. Pointon Ltd., Toronto; 344 pp; $10.45*

Here is a new approach to the design of active circuits. The nonlinearity of electron tubes and transistors has for many years complicated the design of active circuits associated with these devices. This book presents a proven method of overcoming these complications.

The conductance approach utilizes a technique whereby a nonlinear circuit may be linearized on a point-by-point basis. This definitive book explains and illustrates the theory and mathematics involved in this technique. It presents the conductance technique as applied to the design of a wide variety of vacuum tube and transistor amplifier, mixer, and oscillator circuitry. To make the mathematics completely understandable, numerical examples are given throughout.

**Methods of Measurement on Receivers**

*American Standards Association, Dept. PR 48, 70 East 45th St., New York 17, N.Y.; 90 pp; $6 (U. S.).*

The first edition of the International Electrotechnical Commission Publication 91—Recommended Methods of Measurement on Receivers for Frequency Modulation Broadcasting Transmissions—has been issued. The document makes it possible to compare the performance of radio receivers for fm sound broadcasting in the range 87.5 mc to 108 mc. Publication 91 is divided into seven chapters dealing with general information; sensitivity; interference; frequency; response characteristics; distortion; stability and miscellaneous.

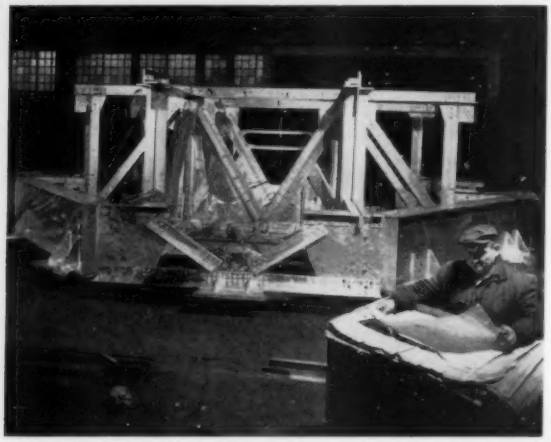
**1959 Atomic Industry Directory**

*Atomic Industrial Forum, 3 East 54th St., New York 22, N.Y.; 132 pp; $2.50 (U.S.).*

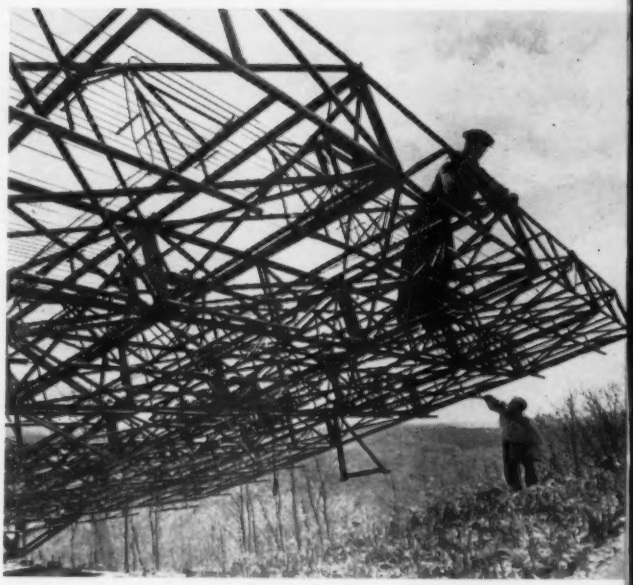
This directory provides data through product and service profiles of more than 200 industrial organizations in the nuclear field. Eleven of the forty major classifications (products, services and equipment) deal with electrical and electronic systems. Included is information on gauges, instruments, accelerators, control equipment and simulators.

**(Continued on page 44)**

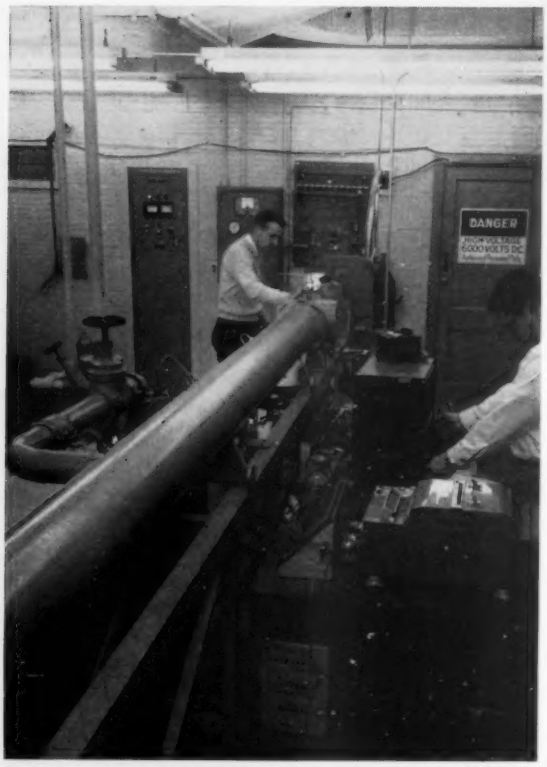
# Electronics reaches into many branches of science and industry



*This is the start of the top section of a radar tower. Built by Blaw-Knox, the 50-foot tower will weigh 140 tons and support an octagonal 50-foot wide platform on which a General Electric search antenna will be mounted.*



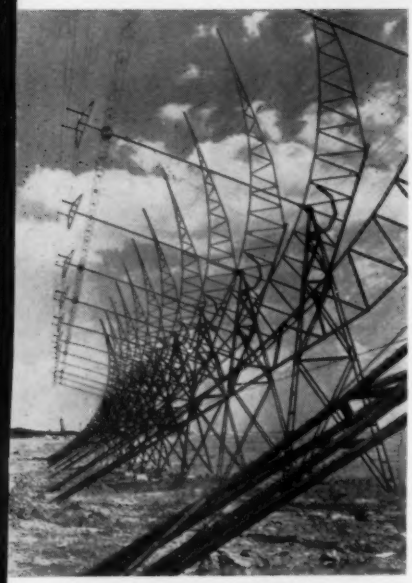
*Workers of the Sun Service of the Far-eastern branch of the USSR Academy of Sciences assemble an antenna of the radiotelescope that will aid study of sun's radiation.*




*This eight inch pilot model is forerunner of 40 inch hypersonic wind tunnel being built by Boeing Airplane Co. Arc discharge in compressed air provides shock wave.*

*This 4 lb transistorized tv camera and 12 lb transmitter developed by Dage Television can send live pictures half a mile to a receiver for distribution to monitors.*

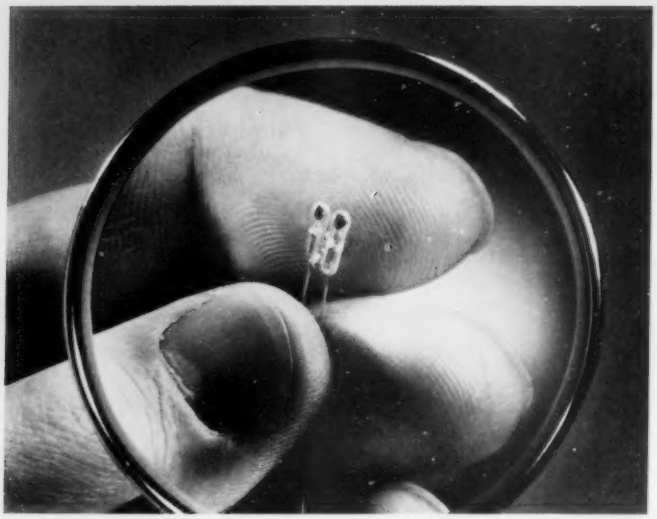
*Skilled operator can sort letters into 144 boxes at rates up to 70 per minute with this British letter sorter. Photo supplied by courtesy of H. M Postmaster-General.*



*This interference radiotelescope antenna in Armenian SSR has mirror surface of 4,500 square metres.*

*Transistors, core stores and printed circuits are used in this Ferranti process control computer designed for a variety of uses in power stations and chemical plants.*

*Picture at right shows intensity of XLS-1 flash developed by Edgerton, Germeshausen & Grier for aerial photography. Self-contained 32-pound unit uses xenon-charged tube operating at 850 vdc. It delivers 90,000 beam candle power seconds at 25 degree beam angle. Flash duration 1/1,000 sec.*



120

125

# New products

## Thermistor probes are interchangeable 120

Thermistor probes with identical resistance-temperature characteristics eliminate the need for individually calibrated probes. At present Fenwal Electronics, Inc., is offering two standard probes with this feature. Absolute resistance of each probe is given in 1 deg F increments from 0 F to 350 F. Resistance changes from 26520 ohms at 0 F, to 70.4 ohms at 350 F indicate the great sensitivity obtainable. Any quantity of the probes is given within 2% of the resistance at any point in the temperature range.

Canadian Chromalox Co. Ltd., Rexdale, Ont.

## Image intensifier tube 121

Light images at levels as low as $10^{7}$ ft candles can be intensified over 1,000 times in light image intensifier tube type WL-7257. The tube produces an image of reduced size having a brightness increase of 1,000 times minimum for input color temperature of 2,870 deg. K, and 2,500 times minimum for actinic blue input. The light quantum gain is approximately 50 for input color temperature of 2,870 deg. K tungsten. For actinic blue input, the quantum gain is 100.

Canadian Westinghouse Co. Ltd., Hamilton.

## Compact fan 122

Measuring only $4^{11}/_{16}$ in. square and 1½ in. thick, the Rotron "Muffin" fan features an inside-out motor with cantilevered bearings and with the air impeller integral with the rotor. The efficient shaded pole motor draws only 13 watts. The fan is designed for continuous duty maintenance-free operation, with a life expectancy of three to five years when operated within the ambient temperature limits of 40 F to 110 F and within the nameplate electrical rating of 105 to 120 volt a-c, 60 cps. It is available in compact skeleton form with venturi ring or complete with grill for front-panel mounting.

The Hoover Company Limited, Hamilton.

## Process timer 123

This process timer directly controls a continuously repeated cycle of operations, without piling up cumulative dead time errors. It works from a recycling loop of punched tape, with the length of loop controlling the cycle time. The sequence of operations is arbitrary and is set up on the tape. The tape actuates a heavy-duty stepping switch with as many outputs as required per cycle. Each contact can handle up to 10 amp at 110 v a-c. The number of outputs ranges from 25 to 288 — each one independent.

Vector Labs. Inc., Montreal.

## Chargers and inverters 124

This no-outage power supply equipment has been designed primarily for telephone company use where microwave and radio carrier systems are in operation. Constant voltage battery chargers operate at a 24 v or 48 v nominal in current ranges from 26 to 300 amp. They are insensitive to voltage and frequency fluctuations of the supply line. They also control power output to maintain voltages within close tolerance for operation of the telephone equipment under emergency power operation.

A complete line of transistorized power supply inverters have been developed to convert the battery power supply into other d-c voltages or a-c voltages as required.

Research Industries Ltd., Vancouver.

## Glass-ceramic radomes 125

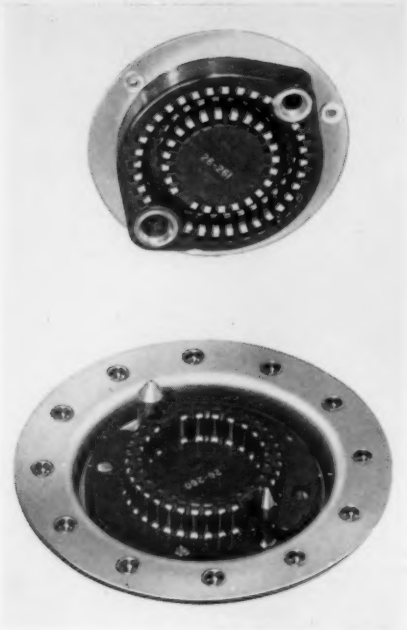
Radomes made of Pyroceram, glass ceramic materials have been produced for use as nose cones on missiles. These materials are melted in the same manner as high-purity optical glass. This produces a homogenous material that assures uniform properties from piece to piece and from point to point within a piece.

Corning Glass Works, Corning, N.Y.

## Chassis punching aids 126

A microbar gauging assembly and a toggle switch control mechanism have been developed to increase the operating convenience of Strippit fabricators. The microbar assembly, mounted on the pantographic duplicator attachment, makes it possible to produce templates or single production pieces to the nearest thousandth of an inch. The assembly consists of one machined bar bridging the duplicator carriage and another mounted on the work table. Both bars are precision drilled and bushed at 1 in. intervals, with dial indicators to provide forward, backward and lateral settings.

The toggle switch mechanism cuts changeover time between template punching and production punching. Punching sheet metal master templates is done by



127

132

foot treadle, while production punching is done automatically by a self-tripping duplicator stylus.

Previously, changeover was made by changing power plugs. The new toggle switch permits instant changeover by switching.

Strippit Tool & Machine Co., Brampton, Ont.

## Circular vapor sealed connector 127

This circular 54-Contact rack and panel style connector has been designed for multicircuit applications in vapor-sealed equipment. The connector has ribboned contacts to provide high contact reliability with very low insertion and withdrawal force. Connector current rating is 5 amp and the voltage rating is 300 volts d-c at 60,000 ft altitude.

Amphenol Canada Ltd., Toronto.

## Insulation resistance test set 128

Isognom crank type insulation resistance test set measures only 3 x 4 x 2 in. The built-in stabilized generator delivers a test potential of 500 volts and reads on a full size 2-in. scale 0 to 50 megohms. Total weight, including 5-ft test leads, is less than half a pound.

Canadian Research Inst., Toronto.

## Loop test set 129

The LP-1A loop test set is a portable instrument which is adapted to field checking of point to point radio systems. Used in conjunction with regular test equipment, it enables one man to make routine settings of transmitter deviation and receiver audio output. In addition, the loop is useful for alignment of receiver r-f and i-f stages and setting of the crystal-controlled local oscillator. It is battery operated and crystal may be interchanged to suit different stations. Transmitter frequency is 140-180 mc, transmitter receiver frequency separation is 5-20 mc. Over-all loop loss is approximately 90 db.

Pylon Electronic Development Co. Ltd., Montreal.

## Computer equipment 130

Auxiliary input-output systems have been designed as optional equipment for the LGP-30 electronic computer for applications that involve a large quantity of data to be processed. Model 341 Reader operates on a photo-electric principle and is capable of reading punched paper tape at a rate of 200 characters per second. Model 342 incorporates both the high speed Reader and a high speed motorized paper tape punch in the same unit. The punch operates at a speed of 20 characters a second. Tapes are fully compatible with the paper tape typewriter provided as standard equipment.

The McBee Company Limited, Toronto.

## Relays for printed circuit assembly 131

Terminals on these relays are located on 0.2 x 0.2-in. co-ordinates to permit mounting on printed circuit boards by automatic assembly techniques. The new terminal layouts are available on both dual coil magnetic latching and on single coil action relays. Both relays operate under 100 g shocks and 30 g vibrations to 2,000 cps. Relays with single coil action pull-in at 260 milliwatts at 25 C; dual coil latching relays at 230 milliwatts. Single coil action SCG relays have eight pins located in two rows of four. Magnetic latching SLG relays have ten pins, two located midway between rows. Both units have dpdt contacts rated at 2 amp, 28 v d-c, resistive.

Potter & Brumfield Canada Ltd., Guelph, Ont.

## 23-inch picture tube 132

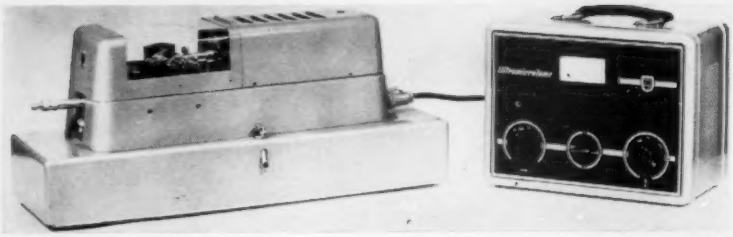
Production has started on the new style 23-in. picture tube. Instead of the rounded corners, common to present picture tubes, the 23-in. tube gives a rectangular picture some 20 sq in. greater than that provided by the 21-in. tube. Because the corners are rectangular, 2 in. are added to the diagonal measurement, while the height and width of the tube remain the same as the 21-in. tube.

The new tube has the safety glass bonded right to the face of the tube, making possible new concepts in cabinet design. The epoxy resin used to bond the safety glass to the face of the tube fills the entire space between it and the tube face. This minimizes reflections from the safety glass back on the tube face and results in about 8% increased light output.

Canadian General Electric Co. Ltd., Toronto.

## Miniature connectors 133

Miniature KM connectors have been designed to meet MIL-C-25955. They feature crimp-type, snap-in contacts to eliminate the soldering process and to facilitate field servicing. Contacts are



**134**

**138**

crimped prior to insertion and then snapped into the zytel monobloc insulation with a special contact insertion tool. A Neoprene grommet eliminates potting. Included in the series are four basic end-bell styles; short, straight, 45 deg. and 90 deg. These may be used in any combination on either plug or receptacle.

Cannon Electric Canada Ltd., Toronto.

### Automatic microtome 134

The Norelco Ultra-Microtome automatically produces thin sections 75 to 400 angstroms for electron microscope study. Section thickness is electrically controlled and single sections 1 to 10 microns thick can be made for optical microscope examinations. The specimen is inserted in a capsule at the end of a metal rod, the latter being rigidly connected through a leaf spring to a magnetic circuit composed of two nickel cores and two energizing coils. When in operation, all movements are actuated by direct current which is switched on and off. Each time the current is on, the magnetic field causes magnetostriction of the nickel cores. This increases the difference between the specimen and the knife and permits clearance during upward movement. Even though current is intermittent, the heating effect in the coils and nickel cores is cumulative and this thermal effect moves the specimen toward the knife. When current flows, the ferroxdure permanent magnet is repelled upward by the solenoid and this section raises the specimen above the knife. At the instant current is cut off, the solenoid force disappears and the specimen drops onto the knife and a microtomed section floats into the tray.

Philips Electronics Ind., Toronto.

### Line frequency monitor 135

For operation primarily in rural locations where power is supplied by generator, the B-43 line frequency monitor senses frequency deviations and closes relays to start auxiliary generating equipment, or take other corrective measures. The monitor operates at 57.5 cps and releases at 59.0 cps. It operates by sensing the difference in output of a frequency sensitive network and an adjustable back-off network. The sensing is done by a transistor controlled relay that is sensitive to less than 30 microamperes of input current. The unit is fundamentally in sensitive to changes in line voltage with a change from 105 to 130 volts shifting the operating points less than 0.1 cps. It is also insensitive to harmonics components in the line frequency.

Vector Labs. Inc., Montreal.

### Type B rural telephone cable 136

Type B rural telephone cable offers telephone companies many cost reducing features during installation and subsequent service. The pairs of conductors are cabled around a central, black polyethylene insulated steel support wire. Unilay construction permits access to the inner pairs of conductors by untwisting the cable. When the tap-in is completed the cable can be retwisted to its original round shape. Primary insulation on the conductors is polyethylene, over which is applied a weather-resistant PVC jacket permitting full color coding and increased resistance to abrasion. The cable is manufactured with six, eleven, twelve, sixteen, or eighteen pairs of No. 19 AWG solid copper and is normally supplied on 4,000 foot reels.

H. K. Porter Co. (Canada) Ltd., Federal Wire & Cable Div., Guelph, Ont.

### Close differential locking relays 137

Close differential electrical locking relays 149XAX1001 (a-c operation) and 49XAX1001 (d-c operation) combine a 149 or 49 close differential relay and a standard B1 frame relay on a common base. Positive contact action at the pick-up and drop-out voltages is accomplished by the B1 frame which acts as a locking relay. Relays may be adjusted to drop-out at 5% minimum below specified pick-up voltages. Operating voltages are available up to 230 v a-c and 115 v d-c; series coils to 10 amp a-c or d-c. Contact ratings are available up to 6 amp at 115 v a-c and 6 amp at 24 v d-c. Relays are available in 1 pole normally open or 1 pole normally closed models.

Renfrew Electric Co. Ltd., Toronto.

### Transistor heat dissipators 138

These International Electronic Research Corp., transistor heat dissipators are capable of providing transistor temperature reductions which permit use of 60% less heat sink area. They are available in various heights for application to any power transistor in a TO-3 case. The typical result obtained with a germanium-type transistor permitted operation at 10 watts, when fitted with a heat-dissipator unit in a 2-in. x 2-in. aluminum plate. Without any means of dissipating its generated heat, the same transistor could not be operated at more than 2½ watts with a maximum junction temperature of 90 C.

R-O-R Associates Ltd. Don Mills, Ont.

### Fastener for blind assembly 139

The Shur-Lok type SL88 clip-nut is a snap-on U type nut plate. It requires only one hole and the fastener is easily slipped over the panel edges. The extrusion on clip snaps into the hole on the panel and the spring holds the clip firmly in place. Performance is to MIL-N-25027.

Railway and Power Engineering Corp. Ltd., Montreal.

### Digital computer 140

Sirius, a fully transistorized desk-size electronic digital computer, has been designed to fill the gap in the small general-purpose computer field. It weighs only 5 cwt, measures approximately 7 x 3½ x 4 ft including a standard office desk, and can be powered by plugging into a power outlet in any office or laboratory. Its chief application is expected to be statistical analysis in industry, commerce and laboratory but it can also perform other types of jobs. Input and output is on

paper tape and a set of 100 buttons, similar to a desk calculator, may be used to operate the machine or put information directly into the main store.

Ferranti-Packard Electric Ltd., Toronto.

## Photomultiplier tube 141

Photomultiplier tube type 9558B has a tri-alkali photo-cathode formed from antimony sodium potassium caesium. This cathode is characterized by a high quantum efficiency between 15% and 20% in the blue region (4,200 angstroms) and an extended red response up to 8,500 angstroms. A typical tube has a photo sensitivity of 100 microamps per lumen, an over-all sensitivity of 200 microamps per lumen at an average of 1,700 volts and a dark current under these conditions of 0.003 microamp.

E.M.I.-Cossor Electronics Ltd., Halifax.

## Epoxy paper base laminate 142

A new premium grade epoxy paper base laminated plastic designated Phenolite grade EP-491 has been developed specifically for printed circuit requirements of computer manufacturers. The new product features flame resistance, good cold punching quality, electrical and dimensional stability properties better than regular XXXP types.

National Fibre Company of Canada Limited, Toronto.

## Instrumentation recording standard 143

A new magnetic recording system has been developed to record 108 channels of multiplexed fm/fm data plus the entire output of a 16-bit digitizer on a single one-inch magnetic tape. The new system increases one-inch tape capacity to 16 digital tracks plus 7 standard analog tracks; or 32 tracks of digital information only. The new heads can be used on existing Ampex laboratory and mobile data recorders and existing systems may be expanded to the new standards by replacing the heads and adding the record and reproduce amplifiers for the desired additional record tracks.

Ampex American Corp., Ottawa.

## Silicone rubber compounds 144

Color-coded silicone rubber compounds permit positive identification of encapsulated and potted materials. Available in a variety of colors PA-407 comes in premetered kits which contain 3 oz. of color-mixed compound plus catalyst. The shrink resistant compound cures at room temperature and sets in approximately 25 minutes.

Plastic Associates, Laguna Beach, Calif.

## Shipping damage detectors 145

Designed primarily for use in shipping missiles, electronic parts and other delicate instruments, V-dot indicators determine if rough or careless handling has caused a shock to the equipment. They give a visible indication when shock has exceeded a predetermined limit. They give complete spherical sensitivity with an accuracy of 5% of preset value; standard models are available from 5G to 75G. The indicators are reusable having life expectancies of about five years. They can be reset, and are protected against tampering with inspectors' seals.

Inertia Switch, Inc., New York.

## Pressure transducer 146

Fairchild Controls corporation model TPH-175 dynamically balanced pressure transducer uses a twin-spring linkage to eliminate pivots or bearings. The pressure-sensing elements are twin bourdon tubes which actuate the wiper of a precision wire-wound potentiometer giving either linear or nonlinear outputs. Overall accuracy including linearity, friction and hysteresis is ±2% with resolution as low as 0.25%. The unit can withstand 55 to 500 cps at 10G vibration with less than 1% error, and 2,000 cps at 25G without permanent shift in calibration or damage.

TPH-176, a differential pressure version, is available for measuring pressures in the 100-5,000-psi range with case pressures up to 5,000 psi.

R. D. B. Sheppard, Ottawa.

## Signalling controller 147

This new signalling controller provides automatic control of industrial operations suitable for two position control action. They can be used with any transducer generating a d-c signal. It is sensitive enough to react to a change of but one microvolt. Calibration accuracy is guaranteed to be within ±0.25% of full-scale span or 5 microvolts. Ranges are available from 1 to 100 microvolts.

The controller also includes a high-gain control amplifier that provides a favorable ratio of signal amplification to component electrical noise suppression. Amplifier stability is ±1 microvolt, power gain is 135 db. Red and green signal lights on the instrument door indicate process conditions.

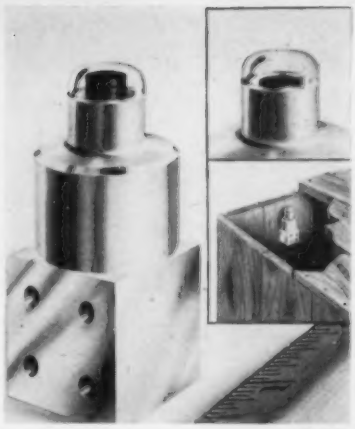
Thermo Electric (Canada) Ltd., Brampton, Ontario.

## Pressure transducer for medical studies 148

For simultaneous recording of intracardiac pressure and sound during catheterization, Telco of Paris, have developed their MSD Micromanometer. Only 2.7 mm in diameter, the transducer may be mounted at the end of a catheter for heart studies.

Frequency response extends to 5,000 cps. with a pressure range of plus or minus 300 mm Hg. When used with Telco amplifiers, the unit produces a pressure signal for direct writing or photographic oscillographs and for oscilloscope presentation, direct reading or pressure on a meter scale, and a sound signal for recording on a photographic oscillograph, tape recorder, or for oscilloscope presentation.

A. C. Wickman Ltd., Toronto. END



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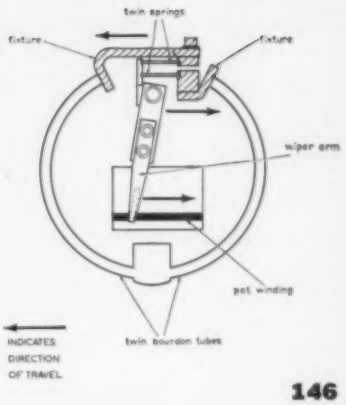


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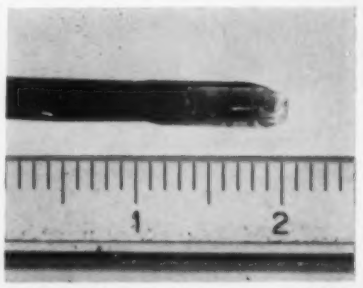


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## People—continued

**Plant manager at Potter & Brumfield**

**Marlin A. Kirk** has been appointed plant manager of Potter & Brumfield Canada Ltd. Mr. Kirk was born in Princeton, Indiana, and educated at Evansville College, Evansville, Indiana. He has been with the parent company more than seven years and joined the Canadian operation in July, 1958.

Kirk

Keddie

**Group Captain joins Renfrew Electric**

A graduate engineer and retired RAF Group Captain has been appointed general manager of Renfrew Electric Co. Ltd., Renfrew, Ontario. He is **William M. Keddie, M.Sc.**

Mr. Keddie is a graduate of Queen's University in mechanical engineering and a graduate of Massachusetts Institute of Technology in aeronautical engineering.

**Chief engineer at CDC**

**Kenneth G. Thorne** has been appointed chief engineer of Computing Devices of Canada Ltd., succeeding J. S. Parsons who recently resigned from the firm.

Born and educated in England, Mr. Thorne graduated from the Polytechnic, London, and gained his earlier experience as a design and development engineer with Electrical and Musical Industries Ltd., England. Following war service as a radar operations officer, Mr. Thorne became chief engineer of S. Smith and Sons (Radiomobile) Ltd., until coming to Canada in 1954 as production officer with the department of defence production. He has also been executive engineer with Ferranti Electric Ltd., Toronto.

Thorne

Martin

**District sales manager.**

**F. J. Martin** has been appointed Ontario district sales manager of E. M. I. Cossor Electronics Ltd. Mr. Martin will be located at 72 Grenville St., Toronto, and will be responsible for all sales and services in that area.

Mr. Martin originally spent five years with Dawe Instruments Ltd., London, Eng., as assistant sales manager and chief sales engineer. In Canada he has been assistant sales manager and customer relations manager for Stark Electronic Sales, Ajax, Ont., and for the past year general sales manager and chief engineer for Conway Electronic Enterprises Reg'd, Toronto.

**Controller and assistant secretary**

New controller and assistant secretary of H. K. Porter Co. (Canada) Ltd. is **Lawrence M. Lake, B.A., C.A.** He is a graduate of the University of Toronto and the Institute of Chartered Accountants of Ontario.

**Engineering appointments at Croven Ltd.**

In his position of chief engineer of Croven Ltd., **Robert B. Corbin** will be responsible for the engineering activities in the design, development and manufacturing of quartz crystals and crystal ovens. Mr. Corbin, a graduate of the Illinois Institute of Technology, has been with Motorola Inc., Chicago, for the past ten years.

**Doyle Rambo** has been appointed senior design engineer in the crystal division. He has had extensive experience in this type of work with the James K. Knight Co. and Motorola Inc., Chicago.

**Directors for Canadian Overseas Telecom. Corp.**

Transport Minister George Hees has announced the appointment of **N. E. Peter Hardy** and **Paul Pelletier** as directors of the Canadian Overseas Telecommunication Corp. for a term of three years. They succeed **Lt.-Cmdr. C. P. Edwards** of Ottawa and **A. F. Mercier** of Quebec City.

Mr. Hardy was born in Toronto and served with the Royal Canadian Navy during World War II. He is head of the firm Hardy Carterage Co. Mr. Pelletier graduated with BA.Sc.E. from l'Ecole Polytechnique of Montreal in 1938. He served with the government during the war and now acts as a consulting engineer. Besides being a member of the firm of Pelletier and Forest and of P. Pelletier Engineering Ltd., he is president of S.E.M. Prospecting Ltd., vice-president of Hydro Technique Ltd., and director of Nordair Ltd.

**Appointments at Burndy**

**Guy Vandry** has been appointed general sales manager of Burndy Canada Ltd., responsible for Burndy sales offices in Montreal, Toronto, Winnipeg, Regina, Calgary and Vancouver. Mr. Vandry was previously eastern district sales manager and utility market manager.

WARNER

Vandry

WARNER

Ward

**Carton Ward** has been appointed chief engineer. Formerly general sales manager, Mr. Ward will now be responsible for expanding the company's application, development and production engineering departments.

**Stuart Holder** has been appointed plant manager responsible for production. Mr. Holder gained much of his experience in major utility and industrial plants in Ontario and Quebec.

PERSONAL STUDIO

Love

WARNER

Holder

**Supervisor for Electrohome**

Dominion Electrohome Industries Ltd., Kitchener, Ont., has appointed **Sydney F. Love,** P.Eng., as supervisor, television engineering, electronic products division.

A native of Winnipeg, Mr. Love finished his elementary school education in Cornwall, Ont., attended secondary school in Toronto, and graduated from the University of Toronto in 1947 with a B.A.Sc. in engineering physics. The next year he received his M.A. in physics and electronics. For two years following graduation he instructed in the university's communications laboratory.

After two more years with Pye Ltd., Cambridge, Eng., Mr. Love returned to Toronto to supervise applications engineering for the Radio Valve Co. He has been with Electrohome since April.

## Reports—continued

**Anthes buys stock in electronics firm**

The Anthes-Imperial Co. Ltd. has negotiated an agreement to buy 50% of the outstanding shares of Powertronic Equipment Ltd., Toronto. In addition, an agreement has been made with an English electronics firm to design, manufacture and instal equipment in Canada for the oil and gas industry.

**Levinthal will build DEW line equipment**

Twelve radar modulators for the DEW line will be built in Palo Alto, California by Levinthal Electronic Products Inc.

The project is covered by a $208,000 contract with Bendix Aviation Corp., holder of the prime contract for the manufacture of the Sentinel Radar. Levinthal's contract with Bendix involves production of equipment based on the Sentinal engineering prototype created by Levinthal in 1954.

**British Columbia joins continental dial network**

British Columbia has joined the continent-wide telephone operator distance dialing system that integrates Canada and the U. S. through a $10,000,000 intertoll network. At cut-over deadline, intertoll switching systems and cordless long distance switchboards in Vancouver and Victoria were thrown into operation at the same time as installations in Edmonton and Calgary. Vancouver will be the focal point of the B. C. network which permits operators in most centres of the province to dial inter-province long distance traffic and calls without the service of operators at the called centres.

**Moon helps open new Eimac plant**

A signal was sent from College, near Fairbanks, Alaska, to San Carlos, California, via the moon to mark the opening of the new Eitel-McCullough plant at San Carlos. This provided a graphic demonstration of Eimac tubes, many of which will be made in the new 150,000 sq. ft. plant.

**ESDA launches campaign to offset publicity**

The Electronic Servicing Dealers Association of Vancouver has launched a 3-month public relations campaign to counteract the unfavorable light in which the trade has been placed by a recent expose in the Vancouver Sun.

The Sun story claimed "that 40% of TV servicemen called to examine a TV set proved to be racketeers who sell unnecessary tubes and charge for work they don't do." It said "the remaining 60% were either honest and efficient or fairly honest."

Although these percentages do not apply to the entire trade, members of The Electronic Servicing Dealers Association, encountered so much mistrust by the public that they felt steps must be taken to correct the situation.

In co-operation with other trades in the Retail Merchants' Association, the Electronic Servicing Dealers have submitted a brief to Vancouver City Council opposing the sale of non-drugs items in drugstores after regular retail store closing hours.

**Government closes telegraph offices**

Thirteen government-operated telegraph offices were closed on Cape Breton Island because commercial telephone service had made their operations uneconomical and unnecessary, according to the Department of Transport.

The department pointed out that persons sending or receiving messages over the Government system had to pay Government rates or other-line-charge plus the commercial telegraph rate from that point to the destination of message. It was generally cheaper for the person to telephone his message to the nearest telegraph office.

**New principals and representatives**

**Lake Engineering Co. Ltd.** has been appointed by Kearfott Co. Inc., Little Falls, N.J., as sole Canadian representative in the field of ferrite components and assemblies.

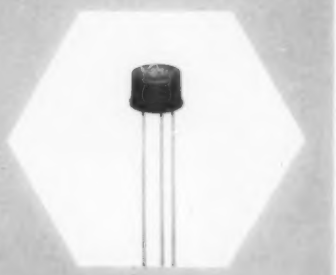
**Pacific Electronics,** Vancouver, has been appointed as exclusive representative for Croven Ltd., in the B. C., Seattle-Tacoma areas. They will handle the quartz crystal and oven product lines.

**MEL Sales Ltd.,** Arnprior, Ont., has been appointed exclusive Canadian representative of Arizona Telemetering Corp., Phoenix, Arizona, manufacturers of solid state subcarrier oscillators. They have also been appointed Canadian representative of Boonton Electronics Corp., Morris Plains, N.J.

**Braun comes to Canada**

Braun of Canada Ltd., a division of the German company, is now located at 35 Haas Road in Rexdale, Ont., and will provide the Canadian market with a complete line of Braun equipment, including radio receiver sets and record players.


TI SEMICONDUCTORS ANYWHERE IN CANADA OVERNIGHT



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# Frequency bridge

The Muirhead D-101-C Frequency Bridge employs the Wien Bridge circuit providing a satisfactory and simple means of measuring audio frequencies, from 100 c/s to 12,100 c/s in two ranges selected by a switch. Measurements to an accuracy ±0·25% are made by means of two decade dials and a continuously variable direct reading dial permitting interpolation between adjacent steps on the second decade. The reading accuracy is always better than 0·05%. The bridge is assembled on a standard panel for rack mounting, provision being made for both jack and binding post connexions.

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## Catalogues and brochures

**Index of Literature.** This 24-page bulletin lists all the literature available from the Industrial and Valve Div. of Honeywell Controls Ltd., Toronto. (101)

**Master catalogue** No. 20 lists PIC Design Corp. instrument, electronic and tool components. Tecneek Associates, Montreal. (102)

**Films for recording.** Wall chart lists characteristics of 16, 35 and 70 mm film used for recording test data. Canadian Kodak Co. Ltd., Toronto. (103)

**Services available from WWV and WWVH.** Bulletin S-159 issued by Specific Products describes services available from WWV and WWVH. E. E. Whittaker, Arnprior, Ont. (104)

**Building cable terminals** are described in sales letter SL-5907. Northern Electric Co. Ltd., Montreal. (105)

**Instruments for measurements** and control in industry and research. 25pp. Polytronics Co., Toronto. (106)

**Gas temperature measurement.** Technical paper by R. E. Rush discusses work done to develop suitable primary elements for measuring point temperatures in gas from 2,500 to 3,500 F. Thermo Electric (Canada) Ltd., Brampton, Ont. (107)

**Industrial reinforced plastics** such as phenolic melamine and epoxy laminates, vulcanized fibre, fishpaper, insulating papers and pressboards are described in 40 page engineering handbook. Spaulding Fibre of Canada Ltd., Toronto. (108)

**High current density** selenium rectifier stacks. Twelve page bulletin provides engineering data. Canadian Line Materials Ltd., Toronto. (109)

**Electronic equipment symbols** used in sound and evacuation systems, intercoms and telephone systems, are illustrated on a wall chart to aid draftsmen. (DuKane Corp.) General Sound and Theatre Equipment Ltd., Toronto. (110)

**Transistor heat** dissipator technical literature. International Electronic Research Corp. 22-page test report No. 414 describes proper cooling of transistors. R-O-R Associates Ltd., Don Mills, Ont. (111)

**Fast acting epoxy** reinforced plastics, technical release No. 7 describes fast cure epoxy systems and the spray equipment to handle them. Bakelite Co., Toronto. (112)

**Conversion charts** and technical data on altitude-pressure, percent relative humidity, temperature conversion, vacuum equivalents, etc. are contained in the Conrad, Inc., 6-page folder. Beechey Enterprises, Weston, Ont. (113)

**1959 general catalogue** of aviation, amateur and broadcast equipment; hf-vhf ground systems; transhorizon, microwave and kineplex systems; components. 78 pp. Collins Radio Co. of Canada Ltd., Toronto. (114)

**Precision potentiometers.** 100-page catalogue provides design information on Spectrol Electronics Corp. potentiometers. E. E. Whittaker, Ottawa. (115)

**Electronic components** catalogue 31. 40 pp. Centralab Canada Ltd., Toronto. (116)

## Defence contracts

Unclassified electronics contracts for $10,000 or more have been awarded to the following Canadian firms by the Department of Defence Production. A figure in parenthesis indicates the number of contracts, the amount being the total value.

**March 16-31, 1959**

Ahearn & Soper Co. Ltd., Ottawa, tubes, $19,527.

Bayly Engineering Ltd., Ottawa, equipment, $46,876 (3).

Canadian Applied Research Ltd., Toronto, aircraft navigational equipment, $107,032 (2).

Canadian General Electric Co. Ltd., Toronto, tubes, $12,352.

Canadian National Telegraphs, Ottawa, rental of teletype facilities during year ending March 31, 1960, $26,118.

Electronic Materiels International Ltd., Ottawa, equipment, $68,297 (3).

Marsland Engineering Ltd., Waterloo, Ont., components, $30,875.

Measurement Engineering Ltd., Arnprior, Ont., equipment, $64,001.

R.C.A. Victor Co. Ltd., Ottawa, components, $42,707.

Standard Telephones & Cables Mfg. Co. (Canada) Ltd., Montreal, equipment, $71,635.

TMC (Canada) Ltd., Ottawa, communications equipment, $13,800; teleprinter motor control units, $14,260.

E. P. Electric Products Co. Ltd., Montreal, ground antenna array at Gander, Nfld., $53,782 (contract awarded by Defence Construction (1951) Ltd.).

**April 1-15, 1959**

Bell Telephone Co. of Canada, Ottawa, rental of teletype facilities during year ending March 31, 1960, $30,000.

Brunswick-Balke-Collender Co. of Canada Ltd., Toronto, repair and overhaul of radomes, $54,250.

Burgess Battery Co., Niagara Falls, Ont., batteries, $141,811 (2).

Canadian Charts & Supplies Ltd., Oakville, Ont., components, $316,073.

Canadian General Electric Co. Ltd., components, $49,602.

Canadian National Telegraphs, Ottawa, rental of teletype facilities during year ending March 31, 1960, $95,000.

Canadian Pacific Railway Co., Ottawa, rental of teletype facilities during year ending March 31, 1960, $110,000.

Carriere & MacFeeters Ltd., Toronto, repair and overhaul of aeronautical instruments and electrical equipment, $10,000.

**(Continued on page 46)**


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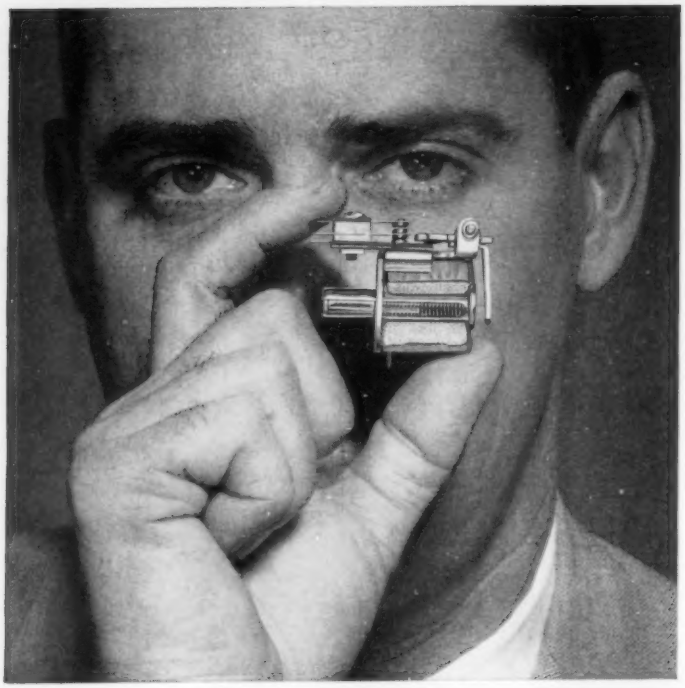

**Worth a closer look . . .** the Heinemann Type A Silic-O-Netic Relay. Despite its small overall size, the relay offers many big performance features.

For example, double-pole, double-throw switching . . . at fast snap-action contact speed.

The relay is a load carrier in itself: it may be energized continuously . . . does not require auxiliary lock-in circuits.

And it has a hermetically sealed time element that is forever free from the effects of aging or fatigue. The Type A Relay has proven itself in countless applications; it will give you reliable service over a long, long operational life.

**For full details, refer to Bulletin T-5002. A copy will be sent on request.**

BRIEF SPECS

**Time Delays:** from 1/4 to 120 seconds

**Overall Dimensions:** 2-1/16" x 2" x 1-9/16"

**Contact Capacity:** 3 amps at 120V AC, 1.5 amps at 240V AC (non-inductive load), 1 amp at 50V DC, 0.5 amp at 125V DC.

**HEINEMANN**

**ELECTRIC COMPANY**

166 Plum St., Trenton 2, N. J.

S.A. 1078

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### *Defence contracts—cont.*

Edo (Canada) Ltd., Cornwall, Ont., sonar equipment, $11,264.

Peterson Electrical Construction Co. Ltd., Vancouver, installation of telecommunication cable, $11,899.

Philco Corp. of Canada Ltd., Don Mills, Ont., technical services, $14,591.

Picker X-Ray Engineering Ltd., Toronto, medical x-ray equipment $22,713.

R-O-R Associates Ltd., Don Mills, Ont., components, $11,365.

TMC (Canada) Ltd., Ottawa, equipment, $21,822.

**April 16-30, 1959**

Aircraft Appliances & Equipment Ltd., Toronto, spares for aeronautical instruments, $20,000.

Ampex American Corp., Ottawa, components, $11,610.

Aviation Electric Ltd., Montreal, repair and overhaul of instruments and equipment, $2,305,225.

Bayly Engineering Ltd., Ottawa, equipment, $28,339.

Bell Telephone Co. of Canada, Ottawa, rental of telephone and teletype facilities, $1,590,000.

British Columbia Telephone Co., Vancouver, rental of telephone and teletype facilities, $259,000.

Burgess Battery Co., Niagara Falls, Ont., batteries, $123,576.

Canadian Aviation Electronics Ltd., Montreal, maintenance, repair and overhaul of operational flight and tactics trainers, $100,000.

Canadian Marconi Co., Montreal, modification kits, $181,420.

Canadian National Railways Co., Ottawa, rental of telephone and teletype facilities, $561,000.

Canadian Pacific Railway Co., Ottawa, rental of telephone and teletype facilities, $340,000; maintenance of teletype equipment, $32,000 (2).

Canadian Westinghouse Co. Ltd., Ottawa, tubes, $199,875.

Computing Devices of Canada Ltd., Ottawa, repair and overhaul of aircraft instruments, $25,000; technical services, $14,500.

Electronic Materiels International Ltd., Ottawa, repair and overhaul of equipment, $382,000.

National Carbon Co., Toronto, batteries, $74,211.

RCA Victor Co. Ltd., Ottawa, components, $15,618.

Rogers Electronic Tubes & Components, Toronto, research contract, $24,725.

School of Industrial Electricity Inc., Quebec, repair and overhaul of instruments and test equipment, $10,000; maintenance of computing and data handling equipment, $10,000.

Servomechanisms (Canada) Ltd., Toronto, repair and overhaul of equipment, $17,825.

Sperry Gyroscope Ottawa Ltd., Ottawa, repair and overhaul of aircraft instruments, $700,000 (2).

Terry Machinery Co. Ltd., Montreal, equipment, $29,043.

**May 1-15, 1959**

Aircraft Appliances & Equipment Ltd., Toronto, repair and overhaul of aeronautical instruments, $36,000.

Airtron Canada Ltd., Toronto, equipment, $36,525.

Aviation Electric Ltd., Montreal, components for aircraft instruments, $176,189.

Bell Telephone Co. of Canada, Ottawa, rental of telephone and teletype facilities, $90,000.

British Columbia Telephone Co., Vancouver, rental of telephone and teletype facilities, $30,000.

Canadian Applied Research Ltd., Toronto, repair and overhaul of instruments and equipment, $1,091,-100 (2).

Canadian Aviation Electronics Ltd., test equipment, $61,218; technical services, $105,045.

Canadian Electrical Supply Co. Ltd., Montreal, spares for radio sets, $11,539.

Canadian General Electric Co. Ltd., Toronto, maintenance of equipment, $350,000; tubes, $81,458.

Canadian Marconi Co., Montreal, tubes, $14,252.

Canadian National Railways Co., Ottawa, rental of telephone and teletype facilities, $10,000.

Computing Devices of Canada Ltd., Ottawa, technical services, $15,915.

Ertel of Canada Ltd., Montreal, fire control equipment, $16,127.

Leavens Bros. Ltd., Toronto, equipment, $14,460.

Levy Auto Parts Co. Ltd., Toronto, components, $34,462.

Micro-Tower Ltd., Scarborough, Ont., equipment, $11,518.

North American Electronics Ltd., Montreal, components, $48,258.

Norwesto Communications Ltd., Kenora, Ont., maintenance of telephone systems, $211,907 (2).

Philco Corp. of Canada Ltd., Don Mills, Ont., technical services, $49,-388 (4).

Radionics Ltd., Montreal, radiacmeters and spares, $38,044.

RCA Victor Co. Ltd., Ottawa, maintenance of equipment, $240,000.

Redifon Canada, Montreal, maintenance, repair and overhaul of flight and tactics trainer, $41,664.

Sparton of Canada Ltd., London, Ont., sonobuoys, $1,247,003.

Stark Electronic Instruments Ltd., Ajax, Ont., repair and overhaul of electronic material, $60,000. END


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FOR ACCURATE READING...INSTANTLY!

Borg Microdials provide fast, accurate dial readings at a glance. The inline digital presentation of these dials permits maximum reading speed even under forced fast reading conditions. Settings are made just as easy . . . just as quick. Finger-tip brake locks settings in place. Available in three-digit ten-turn, four-digit hundred-turn and five-digit thousand-turn models. Also available are concentric scale dials for devices of ten turns or less. Get the complete Microdial story from Borg today.

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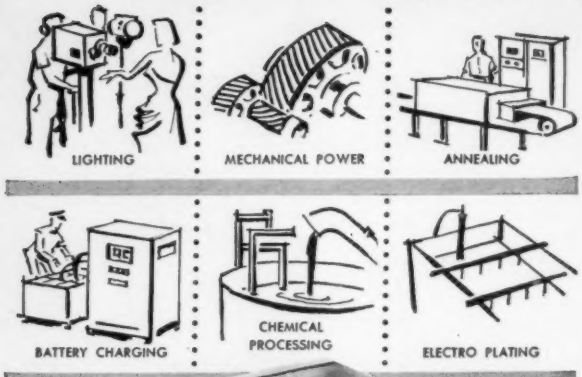
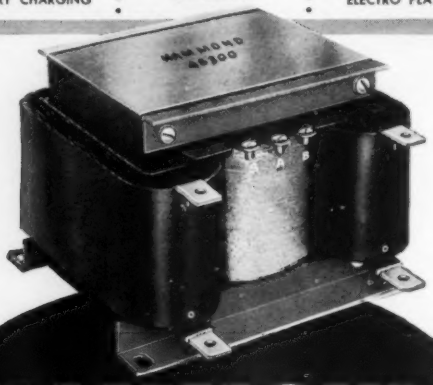
# SMOOTH AND PRECISE ELECTRONIC CONTROL



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Hammond Saturable Core Reactors will control large A.C. powers with small amounts of D.C. Current. They are highly efficient, completely reliable and require no maintenance.

Available in all sizes, from milliwatt level to 50 kilowatts, and for all commercial power frequencies including 400 cycle. A typical Hammond Saturable Reactor, when connected in series with a load, will vary the load voltage from 10% to 95% of line voltage. The D.C. power requirements are generally 2% of the controlled power. The Reactor may be remotely controlled by a small potentiometer.

Saturable reactors are not expensive and have numerous varied applications throughout industry.

Write for Bulletin 5057.

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Small
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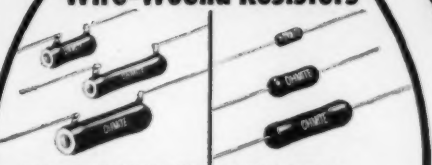

**"BROWN DEVIL"®**
**5-, 10-, 20-Watt Sizes**
Widely used in industry. Construction assures rapid dissipation of heat. Resistance range: .5 to 100,000 ohms.

**AXIAL LEAD**
**3-, 5-, 10-Watt Sizes**
Resistance wire and terminal leads welded to the end cap. Compact mounting. Resistance values: 1 to 50,000 ohms.

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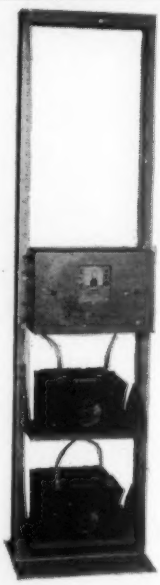

# STANDBY A.C

The PYLON inverter Model I-48-A provides a complete standby A.C. power source of *300-watt rating.*

This unit is equipped with charger/regulator, battery voltmeter, battery shelves and automatic transfer equipment.

Fully transistorized, the I-48-A features high efficiency, sine-wave output and freedom from maintenance. The transfer to standby is so rapid there is no detectable effect on communications equipment.

PYLON

BUY CANADIAN

## PYLON ELECTRONIC DEVELOPMENT company, ltd.

*Communications Systems and Equipment*

161 CLEMENT ST., VILLE LA SALLE, MONTREAL 32, QUE.

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# FROZEN TRANSIENTS

**with the Hughes MEMO-SCOPE® Oscilloscope**

Trial and error methods necessary to capture elusive transients on conventional scopes waste time, film, and precious research dollars. Never again need this happen. With the Hughes MEMO-SCOPE® oscilloscope you may instantly "freeze" wave forms with brilliant clarity for careful study, comparison and analysis.
The Hughes MEMO-SCOPE® oscilloscope retains these frozen transients until intentionally erased. Selected transient information may be triggered externally or internally. Successive wave forms may be written above, below or directly over the original information.

**Sweep Speed for Storage:** 10 microseconds to 10 seconds per division (0.33").

**Frequency Response:** DC to 250 KC down 3 db.

**Sensitivity:** 10 millivolts to 50 volts per division or with optional high sensitivity preamplifier 1 millivolt to 50 volts per division.

**Applications:** Trouble shooting data reduction equipment . . . switch and relay contact study . . . ballistics and explosives research . . . ultrasonic flaw detection . . . physical testing — shock — stress — strain.

**Memo-Scopes®** are stocked in Toronto and Montreal.

R O R

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1470 DON MILLS RD., DON MILLS, ONT.

TORONTO Hickory 4-4429 TELEPHONE MONTREAL HUnter 1-0700

# Famous Players is going to try pay tv in Toronto this year

Canada's first experiment in pay TV is scheduled to take place later this year. Famous Players Canadian Corp. Ltd. will provide the service in the western Toronto suburb of Etobicoke for a potential 13,000 subscribers. The operating agency will be Trans Canada Telemeter.

First run movies will be available to subscribers during the evenings, without interruption from commercials. During the daytime the firm may sell air time to commercial firms so that the subscribers would receive free programs complete with commercials.

Seventy miles of Bell Telephone cables will carry the programs to subscribers' homes. There, an $85 control and meter box will be used to connect the signal into the TV set. Telemeter uses one channel of the TV, giving the subscriber a choice of two movies and a special event program for the cost of about one admission to a theatre. A barker dial announces what programs are in progress and the payment required.

Besides accepting the customers' money, the control boxes will register the price of the program and the credit remaining to the customer. If a program is turned off before completion, credit is given for later viewing.

Initial cost of the service will be $5 to cover installation, but there will be no minimum monthly charge.

*When H. F. Shoemaker, left, handed over the gavel to R. J. A. Turner, new chairman of IRE Toronto Section, he included some advice: "Keep the left index finger out of range." Other officers for 1959 are K. Mackenzie, vice-chairman, and G. T. Quigley, secretary-treasurer.*

*Three Ryerson instructors, Stewart, Kerridge and Jackson (l-r) inspect certificates awarded first graduates of EIA television servicing course.*

## Service technicians complete course

The first class of service technicians has completed the Electronic Industries Association television servicing night-school course. Conducted at Ryerson Institute of Technology in Toronto, the course was sponsored by the television manufacturers through the EIA.

The course, of sixteen weeks' duration will be extended to other cities and towns across Canada this winter. Several changes in the course were suggested by the teaching staff of Ryerson and the members of the first class.

## Canadian cheque sorter will help U. S. bank

The Federal Reserve Bank, New York, has awarded a contract to Ferranti-Packard Electric Ltd., Toronto, a contract to design and manufacture an electric cheque sorting machine.

The machine will be based on techniques employed in the mail sorting computer designed by Ferranti-Packard for the Canadian Post Office Department. The sorting machine, to be fully transistorized, will sort cheques at the rate of 145,000 per hour. It will list incoming cheques and read the magnetic ink characters defining bank, bank number, federal reserve district and amount, then sort these cheques into 16 bundles and list and total the cheques in each bundle.

## COMING EVENTS

**August**

18-21 WESCON: Western Electronic Show and Convention. San Francisco, Calif.

26-Sept. 5 26th National Radio and Television Exhibition, Earls Court, London.

31-Sept. 2 Metallurgical Society of AIME conference on properties of elemental and compound semiconductors, Boston.

**September**

21-25 Annual conference and exhibition, Instrument Society of America, Chicago.

23-25 Technical Conference on Non-Linear Magnetics and Magnetic Amplifiers. Washington, D.C.

28-30 National Symposium on Telemetering. San Francisco, Calif.

**October**

5-7 Fifth National Communications Symposium, Utica, N.Y.

7-9 IRE Canadian Convention, Exhibition Park, Toronto.

12-14 1959 International Systems Meeting of the Systems and Procedures Association of America, Toronto.

12-14 The 15th National Electronics Conference, Chicago.

20-21 Central Canada Broadcasters Assoc., Engineering Conference, Toronto.

29-30 PGED 5 annual electron devices meeting, Washington, D.C.

## *Resources for defense production*

The August issue of CEE will be a special issue called Canadian Electronic Resources for Integrated Defense Production. It will be prefaced by a message from the Prime Minister and will contain an article from Mr. D. A. Golden of the Department of Defense Production explaining to Canadian firms how best they can attempt to obtain defense electronics contracts from U. S. service procurement agencies and prime contractors.

The main body of the editorial will comprise a detailed survey of the capabilities of the Canadian defense electronics industry.

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*This new precision DC VTVM is also a wide range, precision ohmmeter and ammeter!*

# 1% accuracy 100 μv to 1,000 volts!

Also 2% accuracy, 1 μa to 1 amp full scale.

Measures 0.02 ohms to 5,000 megohms.

No zero adjustment. 1 minute warm-up.

Floating chassis. $1,000 worth of convenience for $350!

Haven't you wished for one compact, simple instrument that would make *precision* dc voltage, dc current and resistance measurements over a wide range?

The new hp 412A is it! In its VTVM circuit, the 412A uses an exclusive hp photo-chopper instead of old-style mechanical vibrators—no drift, no 60 cps pickup. Input is floating, with resistance increasing from 10 megohms on the 1 mv range to 200 megohms on ranges above 100 mv. Current and voltage ranges have a 10 db sequence for maximum readability and overlap. The ohmmeter is a modified Kelvin bridge eliminating lead resistance error; you measure resistance accurately on hook-up wire sections as short as 6".

Model 412A also includes a 1 v or 1 ma recorder output, and 3 separate probes. Call your hp rep today for a demonstration on your bench. Price, $350.

**HEWLETT-PACKARD COMPANY**

Represented in Canada by **ATLAS INSTRUMENT CORPORATION, LTD.**
50 Wingold Ave., Toronto, Ontario; 106-525 Seymour St., Vancouver, B.C.;
72 Princess St., Winnipeg, Manitoba

**hp 400L LOGARITHMIC VOLTMETER—$325**

New hp voltmeter covers 10 cps to 4 MC; accuracy high as ±2% of reading or 1% of full scale. Voltage range 0.3 mv to 300 v, 12 ranges, 1-3-10 sequence. Max. full scale sensitivity 1 mv. Large 5" true log voltage scale, linear 12 db scale, generous overlap. High stability, high input impedance. Also useful as amplifier for small signals, or to monitor waveforms.

**hp 400H PRECISION VOLTMETER—$325**

Extreme accuracy as high as ±1% to 500 KC, ±2% to 1 MC, ±5% full range. Frequency coverage 10 cps to 4 MC. Large 5" meter with precision mirror scale. Voltage range 0.1 mv to 300 v; max. full scale sensitivity 1 mv. High 10 megohm input impedance minimizes circuit disturbances. Amplifier with 56 db feedback insures lasting stability. Reads direct in db or volts.

**hp 400D WIDE RANGE VOLTMETER—$225**

Highest quality, extremely versatile. Covers 10 cps to 4 MC. Highly sensitive, accurate to within ±2% to 1 MC. Measures 0.1 mv to 300 v; max. full scale sensitivity 1 mv. Reads direct in dbm. High 10 megohm input impedance virtually eliminates circuit loading. 56 db amplifier feedback insures high stability and freedom from change due to external conditions.

*Data subject to change without notice. Prices f.o.b. factory*

5026

**hp complete precision voltage measuring equipment**

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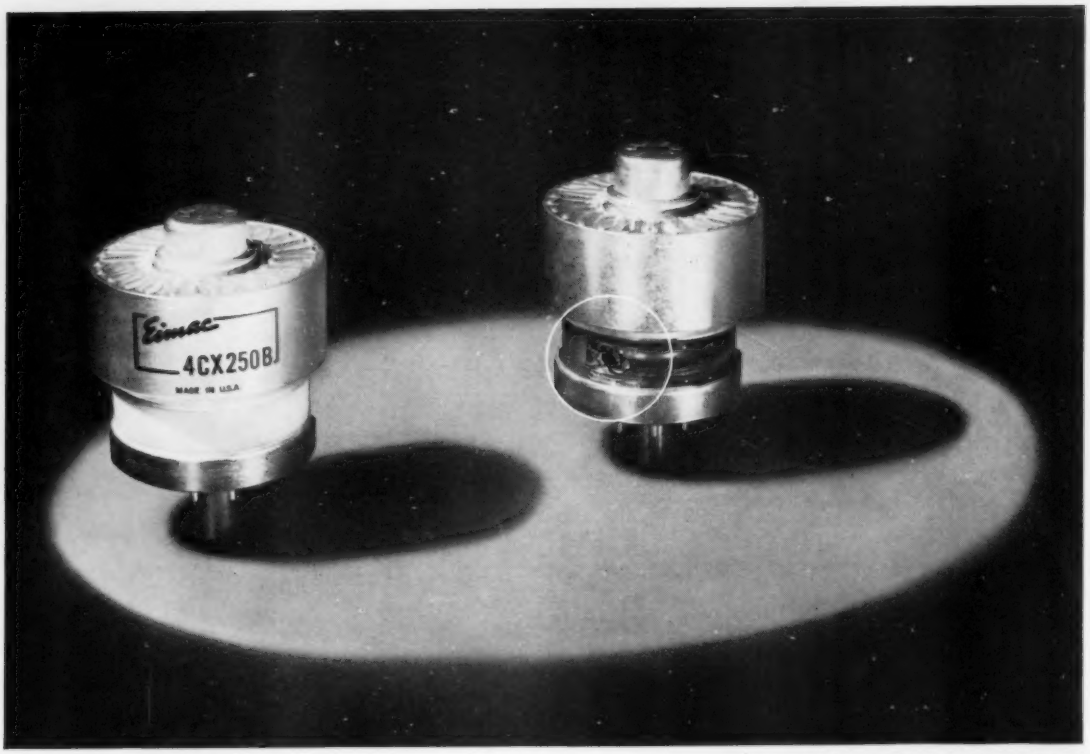


Fifth in a series describing the advantages of ceramics in electron tubes. Previously discussed: impact, heat, vibration, compactness.

# Lower Dielectric Loss
## is an Eimac Ceramic Tube Extra

Ceramic is considerably superior to glass in terms of dielectric loss at high frequencies. The ceramic Eimac 4CX250B and the glass envelope 4X250B shown above were operated in identical 500 megacycle RF amplifier circuits, under identical operating conditions. The glass envelope tube failed catastrophically within a few minutes due to RF heating and puncture of the glass envelope. Further tests of the 4CX250B at 500 Mc. with higher applied voltage showed no appreciable heating of the ceramic envelope material from dielectric loss effects.

Other tests compared glass envelope 2C39A tubes with 3CX-100A5's, their ceramic envelope counterparts. These tubes were operated as oscillators at 2.5 KMc., under identical conditions. The 3CX100A5 ceramic tubes consistently showed a 10% greater output power than the glass envelope type, due to the lower dielectric loss of the ceramic material.

These ceramic tubes are just two of more than 40 Eimac ceramic tube types whose compactness, and resistance to damage by impact, heat, and vibration make them ideal for use wherever exceptional reliability and high performance are demanded.

Write our Application Engineering Department for a copy of the booklet "Advantages of Ceramics in Electronic Tubes".

Eimac

*Eimac First* for high power amplifier klystrons.

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